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COHONINA SOCIAL ORGANIZATION AND THE ROLE OF FORTS IN INTEGRATION AND INTERACTION: A VIEW FROM THE PITTSBERG COMMUNITY

A Thesis

Presented in partial fulfillment of the requirements for the

Master of Arts Degree in Anthropology

Department of Sociology and Anthropology

The University of Mississippi

Travis B. Cureton

May 2014

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ABSTRACT

This thesis explores the role of “forts” in the sociopolitical organization of a prehistoric people known as the Cohonina through the application of settlement systems analysis and functional studies. The primary objective of this thesis is to test ideas of Cohonina sociopolitical organization through an examination of the functional characteristics of forts and their positions on the landscape using a combination of theory derived from settlement and landscape archaeology, deployed in a Geographic Information System work environment. A Cohonina fort site known as the Pittsberg Fort Complex, was placed in its community context through broad scale survey. Artifact, architectural, and settlement data from that site were compared with other recognized Cohonina fort sites in order to establish the function of these features on the intra-community level. Visibility analyses between the Pittsberg Fort Complex and other Cohonina sites were conducted to explore the potential of forts as nodes in a regional visual communication network integrating territorially distinct communities. The results of these analyses determined the primary function of Cohonina forts was not defensive, but integrative. Cohonina forts were built environments wherein ritual behavior was acted out that integrated Cohonina society on both the intra- and inter-community scales. These findings support the Mountain-centric Model of Cohonina social organization which describes semi-autonomous and essentially sedentary communities centered around the major hills and mountains of the Coconino Plateau with an economy that was heavily reliant on intra- and inter-regional trade networks that exerted strong integrating forces on a political economic system prone to segmentation and differentiation.

DEDICATION

In memory of John Thomas Wamble

ACKNOWLEDGEMENTS

First, I thank my committee: Dr. Jay Johnson, for providing the guidance to get through the many setbacks, wrong turns, and digressions; Dr. Matthew Murray for his words of encouragement and patience; Dr. Maurine Myers for agreeing to take me on so late in the game; and Dr. Christian Downum for his willingness to participate in this project, and the invaluable advice and resources he provided.

Their are certain friends, colleagues, and accomplices that went above and beyond the call of duty in helping me realize my goals: Dr. Glen Rice, who guided me through my undergraduate career, provided me work and stability when I needed it most, and suffered through my many phone calls seeking advice and guidance; Neil Weintraub, who over the years has provided my family with friendship and support, without which this project would have never gotten off the ground; David Bustoz, a dear friend who never fails to offer his love, support, and candid advice; Erik Steinbach, another friend whose kind heart, skill in the field, and enthusiasm for this project were invaluable assets; John Rockhill, a friend and true son of Arizona whose deft hand helped create the maps of the Pittsberg Fort Complex and Honani House.

I also thank those individuals who volunteered their time and resources during the survey portion of this project. They include family members, friends, employees and volunteers of the Kaibab National Forest; The Babb and Wamble families, for their generous support and evening conversations; the Bustoz family, which includes little Valentina although she was not yet ready to play under our Arizona sun; the Watkins family, never have I seen such enthusiasm for archaeology; the Grinnell College volunteers including, Noah Fribley, Clare Boerigter, and Yelana Varley, you all suffered my death marches, the swarms of cicadas and juniper gnats with smiles on your faces and ice cream in your bellies; Dan Dybowksi, Ben Phillips, Joel Nicholas (I apologize for the damage to your shoe, donkeys are ravenous and cantankerous beasts), Erin Woodard, Joe Drake, and Ed Henry. I also would like to express my appreciation for the staff and volunteers at the Museum of Northern Arizona who responded so quickly to my research requests, especially Dr. David Wilcox who generously provided his insight on my project as well as providing much needed references.

My deepest thanks to my mother, father, and brothers. This endeavor would have ended in disaster without their love and support. Finally, and most of all, I thank Caitlin Stewart. We struck out from Arizona on an incredible journey that took us first to New Mexico and then to Mississippi. Like all journeys worth remembering, ours was fraught with perils, periods of sublime happiness, and moments of grief and uncertainty. I could not have hoped to have found a better partner to sally forth into the unknown and I thank my lucky stars that our paths crossed all those years ago along el Rio de Agua Fría.

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CHAPTER 1: INTRODUCTION

So. Here are the dead fathers. Their spirit is entombed in the stone. It lies upon the land with the same weight and the same ubiquity. For whoever makes a shelter of reeds and hides has joined his spirit to the common destiny of creatures and he will subside back into the primal mud with scarcely a cry. But who builds in stone seeks to alter the structure of the universe and so it was with these masons however primitive their works may seem to us.

McCarthy (1985)

This thesis explores the role of so-called "forts" in the sociopolitical organization of a prehistoric population known to archaeologists as the Cohonina. No clear picture is yet forthcoming as to how these structures functioned in the Cohonina political economic system or what sorts of public symbolic systems were attached to these ostensibly integrative facilities. Cohonina in the archaeological literature of the Southwest refers to a pottery-making and agricultural folk who occupied the Coconino Plateau of Northern Arizona (Figure 1.1) from about A.D. 550 to 1200 (Hargrave 1937, 1938; Colton 1939, 1946; McGregor 1951, 1967a, 1967b; Cartledge 1979, 1986; Samples 1992; Schubert 2008; Wilcox 1995). The primary indicator of Cohonina contexts is the presence of San Francisco Mountain Gray Ware. The distribution of this ware on the landscape and its clinal boundaries with other recognized wares are taken to represent a Cohonina region and its boundaries (Colton 1946; Garcia 2004; Sorrell 2005).

The primary objective of this thesis is to work out the specific function/s and symbolic meaning/s of Cohonina forts and then use those findings to critically assess two different models of Cohonina sociopolitical organization. The first model known as the "Mobility Model" stresses an economy heavily reliant on hunting and gathering, and to a much lesser extent farming and trade in which relatively autonomous bands engaged in a summer-winter bi-seasonal round between low and high elevations (McGregor 1951, 1967a; 1967b; Samples 1992). The

Figure 1.1. The Cohonina region.

“Mountain-centric Model” describes semi-autonomous and essentially sedentary communities centered around the major hills and mountains of the Coconino Plateau and an economy weighted more towards gathering and hunting than farming, but one in which intra- and inter-regional trade networks exerted strong integrating forces on a system that might otherwise tend towards greater segmentation and differentiation through the influence of ecological constraints on production and trade relations (Cartledge 1986; Hanson 1999; Bone 2002; Schubert 2008).

The specific role of forts as Cohonina integrative facilities has never been seriously investigated, let alone their position in these two rather different views of Cohonina social organization. Hargrave (1933), Colton (1946, 1960) and later Garcia (2004) argue forts actually were purpose-built defensive installations, but these arguments are based almost solely on the interpretation of one structure at one site (NA 862, Medicine Fort) and those arguments are not easily extended to other known forts. Cartledge (1986) and later Hanson (1999) suggested forts may have had a communicative function, but this notion was not explored by either researcher and no attempt was made to evaluate this idea in terms of the two models of social organization just described. Bone (2002) made a study of Cohonina public architecture types by comparing several attributes between forts, plazas, and ballcourts. However, Bone’s investigation argued only that the markedly larger size of these edifices when compared to other architectural remains identified them as socially integrative, hence side-stepping the problem of working out the specific function/meaning of forts.

Thus this investigation attempts to test ideas of Cohonina sociopolitical organization through an examination of the functional characteristics of forts, and their positions on the landscape. Functionalist analysis in archaeology focuses on relationships between cultures and their environments and how various sorts of material culture were made and used. These latter sorts of analysis are integral to archaeological interpretation, but are also fraught with potential pitfalls because they often seek to bring together both behavioral and cognitive inferences, especially when it comes to “public,” “ritual” or “integrative” architecture. The considerable difficulty in accomplishing this goal means functional interpretation of Cohonina public architecture is often side-stepped, left vague, or falls under the purview of intuitive interpretation. In order to constrain interpretation, stay close to the evidential limits of the material at hand, and head-off unsubstantiated speculation, I rely on an assembly of theoretical tools falling under the rubrics of settlement archaeology and its counterpart, landscape archaeology. This foundation allows the analysis of settlement systems data at multiple scales which in turn produces a strong empirical basis from which to make a serious effort to test hypotheses revolving around the function of forts and their meaning, and the nature of Cohonina sociopolitical organization.

I accomplish this task by reevaluating data from the Pittsberg Fort, one of only four Cohonina forts ever excavated, and placing that site within its community context through intensive settlement survey. I then compare artifact and architectural data between other recognized Cohonina forts in order to establish the integrative function of these features on the intra-community level. Finally, I conduct viewshed and line-of-sight analyses between the Pittsberg Fort and other Cohonina public sites in order to explore the potential of forts as nodes in a regional communication network integrating territorially distinct communities. I rely on geographic information systems (GIS) software (ArcGIS) which is capable of handling the immense data sets required to accomplish these tasks. I hypothesize that Cohonina society is best described by the Mountain-centric Model of independent hill communities that controlled land tenure within their resource catchments, but were nevertheless strongly integrated through political-economic networks based on trade and maintained by a public symbolic system embodied in forts, plazas, and ballcourts.

In Chapter 2, I situate the overarching effort of this thesis in its environmental context, taking the Coconino Plateau as a unit of analysis. This exercise provides broad descriptions of the Coconino Plateau as well as detailed descriptions of the conditions within the project area, which include discussions on physiography, geology, and ecology. Understanding the Coconino Plateau's diverse and complex environment, to which prehistoric human populations developed equally diverse adaptive strategies, forms a critical starting point of any rigorous investigation of Cohonina sociopolitical organization.

In the Southwest, gathering, hunting, and agriculture were the broadest economic endeavors humans employed during the prehistoric period to provision themselves, meaning these activities conditioned prehistoric human-environment interaction on the Coconino Plateau. The Coconino Plateau's considerable environmental diversity in turn determined the precise formulation of these themes past folk developed across the plateau and over time. The general environmental themes of aridity, climatic instability, and great geographic variability also set limits on the field of possibilities in terms of those economic arrangements. Contemporary studies of Coconino Plateau ecology (Bills et al. 2007) provide the starting point to understand these limiting factors and the considerable body of accumulated paleoclimatic knowledge focused on the Colorado Plateaus (Antev 1955; Euler et al. 1979; Dean et al. 1985; Weng and Jackson 1999; Cook et al. 2004) provide the scholarly thrust to understand how these factors operated in the past. These opportunities and restrictions are the hard surfaces of life that provide the launching off point to discuss past cultural systems.

In Chapter 3, I engage in a brief examination of the history of archaeological thought on the Cohonina. Potential reasons for taking up this task are numerous, ranging from general inquiries into the production of scientific knowledge to questions concerning the validity or origin of specific archaeological interpretations. Engaging in a serious historical effort from the perspective of the goals of this thesis stands to reign in the influences of the social milieu in which I and my interpretations exist while simultaneously providing a basis to systematically appraise existing bodies of thought (Trigger 2006). The value of this approach is well attested by the success of Downum's (1988) analysis of the history of archaeological research in Northern Arizona in the context of reassessing the methods of archaeological chronology employed in that region. This effort takes place in the context of Trigger's (2006:17) thematic approach to the study of the history archaeology, e.g. culture-historical or processual/postprocessual archaeologies. Other approaches certainly exist (Willey and Sabloff 1974), but Trigger's is the more attractive because it can handle the waxing and waning approaches to archeological interpretation that Cohonina archaeology has witnessed.

I begin with a brief outline of Southwestern archaeology followed by a discussion of the early period of Cohonina archaeology. This includes the genesis and development of the Cohonina concept in relation to broader themes within the discipline. In this context I discuss the 1938 Museum of Northern Arizona (MNA) expedition to sites north of Williams, Arizona which represents the foundational excavation data this thesis relies on. Lyndon L. Hargrave (1938) led the expedition which consisted of limited survey and excavations including a "full" excavation at the Pittsberg Fort. I also engage in a critical review of Thomas Cartledge's critique (1979) and synthesis (1986) of Cohonina archaeology. These two documents have driven Cohonina research for nearly four decades and along with later studies they inspired (much of it being unpublished masters theses, contract archaeology reports, and manuscripts, the so-called "grey" and "black" literature of archaeology) represent our current understandings of Cohonina archaeology. Within this context I also describe the regional archaeological database maintained by Kaibab National Forest (KNF) that this thesis relies on to conduct regional analysis. I discuss its origins, structure, and delineate its strengths and weaknesses. Finally, I describe the evolution of the Cohonina fort concept as well as the two competing models of Cohonina sociopolitical organization and they data they rely on.

Chapter 4 provides a theoretical orientation and describes the specific methods used to accomplish the goals of this thesis. I structure the first effort through a description of two closely related bodies of theory and how they will guide the collection of data, its analysis and interpretation. This first body of theory known as "settlement archaeology" is traceable in North America to Julian Steward and Gordon Willey (Willey 1953). This approach to archaeological phenomena focuses on the collection of spatial, temporal, and functional data from extensive survey areas in order to track behavioral change through time and space. Settlement archaeology provides a set of analytical tools for the systematic study of economic, social, and political organization (Trigger 2006:377) and thus forms the methodological foundation for this thesis. Success in settlement archaeology relies on my ability to accurately record spatial relationships, build chronologies, and infer site function. Thus I discuss the role of Geographic Information

Systems (GIS), Southwestern approaches to archaeological chronology and the analysis of public architecture in settlement archaeology, and how they apply to the Cohonina region.

The second body of theory referred to as landscape archaeology is traceable to British archaeology, especially Ian Hodder (1984) and his studies of the relationship between settlement, symbol, and geography. This approach seeks to understand the meanings that prehistoric peoples attributed to the landscapes they occupied and how those thoughts structured human activity (Trigger 2006:473). Landscape archaeology then, provides the theory necessary to access pre-historic symbolic systems and thus is a logical counterpart to the behaviorally oriented approach of settlement archaeology. Both settlement archaeology and landscape archaeology depend on the same sorts of data collection (survey) and analysis (GIS) which means these schools of thought are easily brought into articulation with each other to form a comprehensive theoretical framework.

I deploy this theoretical framework in a GIS based approach that seeks to understand the symbolic linkages between forts, their elevated positions on the landscape, hills and mountains as community symbols, and the role that line-of-sight connections played within that symbolic system. I describe how I carry out settlement survey, what site attributes are recorded, and how previously collected data are incorporated into those findings. I describe how I approach ceramic analysis and archaeological chronology. Following those descriptions, I describe the GIS based methods of viewshed/line-of-sight analysis which seek to test whether or not intervisibility was an important factor Cohonina architects considered while in the process of constructing their integrative facilities. The specific intervisibility methods used go beyond merely pointing out that line-of-sight connections exist between archaeological localities. These methods test whether or not those connections were created intentionally and are not merely a consequence of topography by constraining interpretation and banishing equifinality. This effort relies on high resolution digital elevation models (DEMs), the several thousand site KNF archaeological database and a fine-grained chronology (established through multiple methods) demonstrating contemporaneity among identified public sites.

In Chapter 5, I present the results of the Cureton Ranch Reconnaissance Project (CRRP). This chapter provides a description of the project area including locational and administrative particulars. After this basic introduction I present the results of the foundational data collection goals of this project which consist of identifying the remains of a Cohonina community in total by characterizing its environmental setting, structural components, and historical development. Survey was carried out on the Cureton Ranch and a small portion of the KNF bordering the ranch and included intensive block survey around the Pittsberg Fort (0307010889, NA3577). This effort allowed me to fully characterize the remains of a Cohonina community by bringing into articulation two distinct data sets represented by the 1938 MNA expedition and the KNF archaeological database at the locality of the Pittsberg Fort. This synthetic effort creates the high resolution and extensive data set, both temporally and spatially, required to test hypotheses of how Cohonina communities used their public architecture and surrounding landscape as symbolic systems to participate in a larger regional system. Finally, I present the results of the intervisibility analysis between Cohonina integrative facilities.

In Chapter 6, I use the results of the CRRP and data produced from the only other Cohonina forts excavated (Medicine, Deadmans, and Red Butte Forts) to develop a functional theory of Cohonina forts. I critically assess the entrenched defensive theory and the data upon which it relies. This assessment opens up a broader discussion on the validity of the notion that these features were socially integrative in a general sense; that is forums for a process of cooperation coordination that occur through ritual. An examination of the Pittsberg Fort relative to its "site structure" and "community pattern" (Lipe and Hegmon 1989a) reveals broad support of the latter interpretation. I engage data concerning architectural reconstructions, floor assemblages, and use-history to propose Cohonina forts were "multiple use" (Adler 1989) facilities that supported both secular and ritual activities at the community level. I then use the results of the intervisibility analysis to examine intentionality and meaning in line-of-site connections between Cohonina public sites. Line-of-site connections might have been established for a great many reasons in the past, but demonstrating intentionality and then examining that aspect of public architecture in its broader social context stands to constrain interpretation. I use the results of this analysis to support the proposition that Cohonina forts were also ritual facilities that integrated Cohonina society at the inter-community or regional level. Thus the overall approach taken in developing a functional theory of Cohonina forts is quintessentially multiscalar in orientation in that it investigates intra- and inter-community interaction and integration from the vantage point of one Cohonina settlement.

In Chapter 6, I also discuss the ramifications of this study in terms of undermining or supporting a particular model of Cohonina sociopolitical organization. I argue Cohonina society was organized as a segmentary political economic system characterized by horizontal complexity and potentially organized by the concept of complementary opposition (Evans-Pritchard 1940; Rice 2001) and thus supports the Mountain-centric model of Cohonina sociopolitical organization. The study of segementary organizations has been approached through the concept of "heterarchy" (Ehrenreich, Crumley, and Levy 1995) as an alternative to the heirarchical models that dominated archaeological discourse until quite recently. I prefer "segmentation" over "heterarchy" because the former describes a specific sort of social structure while the latter is a broader term applied to all those cases that are *not* hierarchical. However, heterarchy does provide a theoretical basis to explore how power is manipulated in societies lacking central, hierarchical control (McIntosh 1999a:75). Regardless, the Mountain-centric model takes into account the limiting factors that Coconino Plateau ecology placed on emerging complexity in Cohonina society as well as the seemingly contradictory evidence of considerable political and economic autonomy between individual sedentary communities and a high degree of regional integration. Thus this study is part of a growing effort within archaeology to broaden analytical focus beyond models of vertical stratification and evolution informed by the Polynesian prototype (McIntosh 1999b). This chapter concludes with a note on the successes and shortcomings of this thesis and the potential of predictive modeling to drive future Cohonina research.

CHAPTER 2: ENVIRONMENTAL SETTING

In this chapter I situate the overarching effort of this thesis in its environmental context, taking the Coconino Plateau as a unit of analysis. This exercise provides broad descriptions of the Coconino Plateau as well as detailed descriptions of the conditions within the project area which include discussions on physiography, geology, and ecology. Julian Steward and F.M. Setzler (1938) long ago realized the role that ecological factors play in shaping the arrangement of sociocultural systems. Steward (1949) also realized the importance of understanding how the interrelationships between ecology, production, and social structure bring about change. Thus understanding the Coconino Plateau's diverse and complex environment, to which prehistoric human populations developed equally diverse adaptive strategies, forms the starting point of any rigorous investigation of Cohonina sociopolitical organization.

The Project Area

The project area (Figure 2.1) is located in the southwest portion of Coconino County, Arizona. It is approximately 8.85 kilometers (5.5 mi.) north-northeast of the City of Williams on private lands and federally administered public lands. The privately owned portion of the project area is held by the Cureton Ranch, totaling approximately 318 hectares (786 acres). It consists of portions of Sections 3 and 4, Township 22 North, Range 2 East; and Section 34, Township 23 North, Range 2 East, Gila and Salt Rivers Baseline and Meridian, U.S.G.S. Williams North, Arizona 7.5' Series Topographic Map 1958, edited 1989. Also included in the project area is the remainder of Section 3, Township 22 North, Range 2 East, bordering the Cureton Ranch to the south and totaling approximately 251 hectares (620 acres). This section is

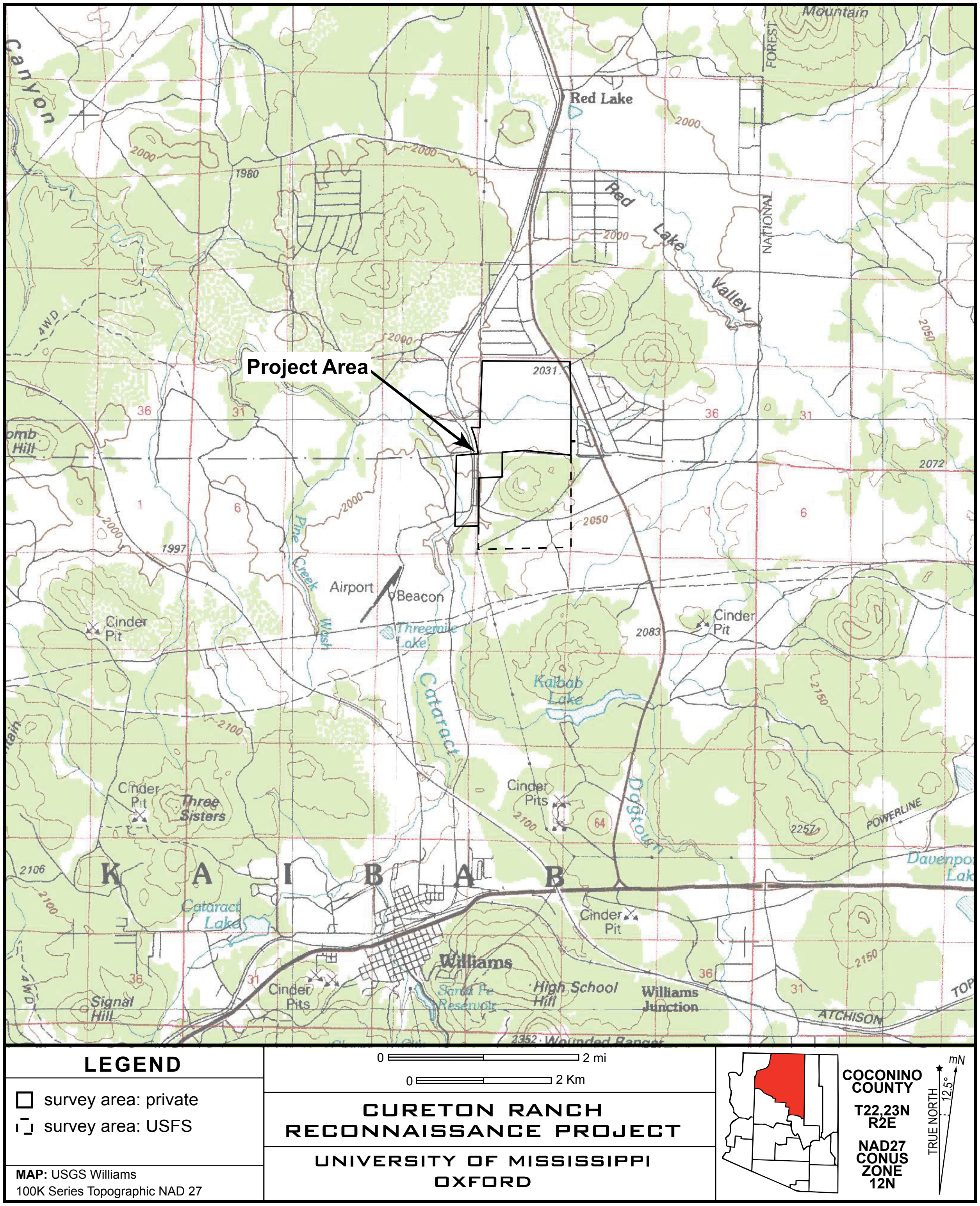

Figure 2.1. The project area.

public land administered by the United States Department of Agriculture, United States Forest Service, Kaibab National Forest. The total survey area includes Section 3 and part of Section 4, Township 22 North, Range 2 East; and Section 34, Township 23 North, Range 2 East; creating a total project area of approximately 569 hectares or 1,406 acres (2.20 mi^2). Thus the project area is bounded by the combined property lines of the Cureton Ranch and the section lines of Section 3, Township 22 North, Range 2 East.

Coconino Plateau Physiography

The physiographic province of the Colorado Plateau dominates the north portion of the North American physiographic region of the Southwest (Bills et al. 2007). The project area falls within the southwestern-most sub-province of this region, called the Coconino Plateau (Figure 2.2). Dramatic changes in elevation define the borders of the Coconino Plateau and set it apart from adjoining physiographic structures. The northern extent of the plateau is abruptly terminated by a 1,524 meter (5,000 ft) drop from the edge of the south rim of the of the Grand Canyon to Colorado River below. The Mogollon Escarpment represents the southern boundary, dropping more than 914 meters (3,000 ft) into the Verde River Valley. The western and southwestern boundaries of the plateau are less well defined where the Colorado Plateau transitions into the Basin and Range Physiographic province. Along this edge unconsolidated sediments overly northwest-north striking faults that parallel the end of the Mogollon Escarpment. In some areas the vertical offset of these faults reaches heights above 91 meters (300 ft, high side on the east). The Echo Cliffs Monocline, the Black Point Monocline, and the Mesa Butte and Cedar Ranch Faults makeup the eastern edge of the Coconino Plateau and have a combined vertical offset of more than 914 meters (3,000 ft, high side on the west).

In the Southwest, gathering, hunting, and agriculture were the broadest economic endeavors humans employed during the prehistoric period to provision themselves, meaning these

Figure 2.2. The Coconino Plateau of Arizona.

activities conditioned prehistoric human-environment interaction on the Coconino Plateau. The Coconino Plateau's considerable environmental diversity in turn determined the precise formulation of these themes past folk developed across the plateau and over time. The general environmental themes of aridity, climatic instability, and great geographic variability also set limits on the field of possibilities in terms of those economic arrangements. These opportunities and restrictions are the hard surfaces of life that provide the launching off point to discuss past cultural systems.

Erosion and volcanism were the major geologic forces that shaped topographic relief on the Coconino Plateau. Paleozoic and Mesozoic flat-lying sedimentary rocks, followed by Tertiary and late Cenozoic volcanics, sedimentary rocks, and unconsolidated sediments form the ground surface across the plateau. Cenozoic era uplift is responsible for most of the Coconino Plateau extending above 1,524 meters (5,000 ft) in altitude. The bedrock at land surface over the majority of the plateau is composed of limestone which Laramide erosion transformed into low topographic relief consisting of isolated hills and mesas, wide valleys and internal drainages. Cataract Canyon nearly divides the plateau in half along the north-northwest running Cataract Syncline. This ephemeral and northerly meandering tributary of the Colorado River has cut a deep canyon at the northern end of the plateau. At Havasu Spring, Cataract Creek becomes a perennial stream – named Havasu Creek – before discharging into the Colorado River. Other principal drainages include Hell Canyon, Sycamore Canyon and Oak Creek Canyon; all of which drain into the Verde River south of the Coconino Plateau.

The limestone dominated landscape presented several challenges and benefits to the prehistoric occupants of the Coconino Plateau. Low topographic relief on the Kaibab formation does not impede travel except where deep canyons exist. Kaibab chert occurs throughout this formation and is an economically useful toolstone. However, limestone parent rocks produce thin, poor soils and their permeability means water is scarce. These factors create conditions that favor economic formulations based on gathering and hunting, but not agriculture.

In the southern third of the plateau extensive volcanic deposits (Chronic 1983:199) overlie limestone basement rock. Topographic relief in this area consists of low relief, punctuated by frequent volcanic features emanating from two distinct volcanic fields (Mt. Floyd Volcanic Field [MFVF] and San Francisco Volcanic Field [SFVF]) The collapsed stratovolcano of San Francisco Mountain lies near the SFVF's geographic center and dominates the landscape with an elevation of 3,769 meters (12,366 ft) at its highest point (Holm 2004:335-346). The thickness of volcanic deposition within the MFVF and SFVF ranges widely from a few meters of cinders to more than 1,524 meters (5,000 ft) of layered deposits at Bill Williams Mountain and San Francisco Mountain. For these reasons elevations tend to be higher in this portion of the plateau compared to that of the north. Other principal mountains formed by these volcanic fields include Mt. Floyd (MFVF), Sitgreaves Mountain, and Kendrick Peak (SFVF). Total relief for the Coconino Plateau is more than 3,200 meters (10,500 ft) with the highest point at Humphrey's Peak (3,769 m or 12,633 ft) on San Francisco Mountain and the lowest point at the mouth of National Canyon (530 m or 1,740 ft) in the Grand Canyon.

The greater topographic relief of the volcanic portion of the Coconino Plateau presented a number of opportunities to its prehistoric occupants. Precipitation is higher in this portion of the plateau compared to that of the north and high mountains retain snow packs. These conditions mean permanent water clusters around these features, making agriculture possible. Biotic diversity is greater within the volcanic fields, making gathering and hunting productive endeavors. The volcanic portion of the Coconino Plateau was also desirable because it boasts six known sources of high quality toolstone (Shackley 2005). However, elevations are high in this portion of the plateau, meaning potential agriculturists had to contend with a short growing season. The volcanic rocks of the southern plateau, like that of the north, also produces poor soils and are water permeable, making agriculture that much more challenging. These factors mean opportunities for agriculture were greater in this portion of the plateau, but were by no means ideal. Gathering and hunting would still have to play significant roles in the economies of Neolithic Coconino Plateau folk.

Soils on the Coconino Plateau generally originate from either limestone or volcanic parent rocks. Over much of the plateau the limestone bedrock provides the parent material for pedogenesis. Soils that form directly on limestone are generally shallow, gravelly loams. Broad drainage bottom deposits of limestone-derived alluvium are interspersed throughout the northern portion of the plateau and occur in the southern portion where streams have cut below volcanic cap deposits. In the southern portion of the Coconino Plateau volcanic deposits provide the parent material for pedogenesis. Soils derived from these rocks are generally clayey, containing large pebbles and in some areas, thick deposits of cinders form the principal surface material. Beyond this two-part generalization other parent materials supporting soil formation include Quaternary aged unconsolidated alluvial, colluvial, glacial, and landslide deposits. As stated before, these generally thin soils are not particularly amenable to agricultural endeavors.

Coconino Plateau Climate

The climate of the Coconino Plateau is similar to that of the southwestern region generally. The typical pattern of general aridity and maximum sunshine in the semiarid to arid Southwest is broken up on the Coconino Plateau by clines in temperature and precipitation correlated to differences in elevation and localized topography. Coupled to these spatial variations are temporal cycles in precipitation and temperature that have seasonal, decadal to multidecadal, centennial, and quincentennial periods which manifest as variably oscillating periods of wet and dry (Euler et al. 1979; Cook et al. 2004). Finally, these climatic oscillations piggyback a long term warming trend in the Southwest dating to the beginning of the latest interglacial (Weng and Jackson 1999).

Antev (1955) presented a tripartite schema for the whole of Southwestern North America that characterizes long term climatic change from the start of the Holocene to the present. He describes the early Holocene period, “Anathermal” (10,000 to 7,500 B.P.) as increasing in temperature coincident with continental ice withdrawal. The following “Altithermal” (7,500 to 4,000 B.P.) period sees continuing increases in temperature coupled with increasing aridity. The “Medithermal” (4,000 B.P. to present) period is characterized by a retreat from the postglacial temperature maximum that occurred in the Altithermal with a corresponding increase in moisture. Antev’s regional model for the Southwest is generally applicable to the Coconino Plateau, but Smiley (2002:16) warns that local paleoclimates reveal a great deal more complexity than is presented in Antev’s broad scale schema.

The availability of water at year-round sources is quite limited across the Coconino Plateau. While perennial streams of the Colorado River Drainage Basin virtually surround the Coconino Plateau, there is a paucity of surface water on the plateau proper in the form of streams, springs and lakes. This is attributable to the permeability of the bedrock at land surface over much of the Plateau (Chronic 1983). Year round sources of water on the Plateau proper cluster on the flanks of the larger mountains in the form of springs and seeps, while other springs are found where stream courses cut into the Redwall-Muav aquifer below the plateau rim (Bills et al. 2007). Small bedrock basins, or tinajas, found within stream courses provide another important source of year round water. Agricultural pursuits would have been most successful at these locations, especially around the larger hills and mountains, and hence would have supported the most substantial settlements.

These general observations aid in sketching the climatic conditions of the Coconino Plateau as it is today. Average annual temperatures range from 6°C (43°F) on the Flanks of San Francisco Mountain to 20°C (68°F) at the bottom of the Grand Canyon. Subzero winter temperatures occur at higher elevations and some canyon bottoms. Summer extremes over 38°C (100°F) occur across much of the plateau with temperatures over 43°C (110°F) occurring in canyon bottoms. The number of frost free days is typically between 140 and 150. Annual precipitation is strongly correlated with altitude with less than 38 cm/yr (15 in) below 5,000 ft and more than 64 cm/yr (25 in) above 7,000 ft; the average across the plateau being 24 cm/yr (9.5 in). The year is broken into winter and summer wet periods punctuated by spring and fall dry seasons.

The winter wet period consists of Pacific storms leaving heavy snow accumulations at high altitudes that contribute to substantial runoff during the spring, while lower elevations experience less frequent rain. A monsoon pattern originating over the Gulf of California and Gulf of Mexico dominates the summer wet period. These rains are highly variable both spatially and temporally. Localized areas can experience extreme downpours with flash flooding while adjacent areas receive little or no precipitation.

A considerable body of accumulated paleoclimatic knowledge focused on the Colorado Plateaus provides the data necessary to understand how these climatic themes operated in the past. Smiley's (2002) research on Black Mesa indicates the general themes of the contemporary seasonal cycle were in place across the northern Southwest by at least 5,000 B.P. Euler and colleagues (1979) used regional tree-ring indices, dated soil sections, hydrologic data, and pollen profiles to identify three climatic cycles of varying wavelength that describe effective moisture for the period 300 B.C to A.D. 1970. A primary hydrologic cycle averaging 550 years was responsible for long term climatic change. A secondary cycle averaging 275 years created a two-fold subdivision of the primary cycle. A less stable tertiary cycle varying from 50 to 100 years in length were superimposed on the primary and secondary oscillations. Finally, ten to twenty year oscillations departing from the running average are evident in tree-ring indices. The authors demonstrate this climatic model is consistent and synchronous across the Colorado Plateaus, allowing for variation between local microclimates; meaning their model is readily applicable to the Coconino Plateau (Euler et al. 1979:1097).

For the time period examined in this thesis (A.D. 550 to 1200), Euler et al. (1979:1096-1097) and later Dean et al. (1985:540-542) and Cook et al. (2004:1016) identified two iterations of the primary hydrologic cycle dating to A.D. 350 to 875 and 875 to 1450 respectively. Secondary peaks of high effective moisture superimposed on the primary cycle occur at A.D. 550, 700, 1050, and 1250. They also describe three episodes of profound drought at A.D. 600, 850 to 900, and 1150. Finally, Euler et al. (1979:1096) and Dean et al. (1985:546) identify the period between A.D. 950 to 1150 as the best documented interval of high effective moisture and generally salubrious conditions known for the Colorado plateaus. The intervals between the three episodes of profound drought, especially the A.D. 950 to 1150 period, would have been most amenable to mixed economies based on gathering, hunting, and horticulture. Cultivated crop yields such as maize as well as wild resource harvests, especially piñon nuts, would have been sufficient to support expanding populations. However, the episodes of profound drought that bracket these "good times" would have had deleterious effects on established adaptive systems and could have dropped carrying capacities on the plateau below critical thresholds needed to support high population densities.

Coconino Plateau Biotic Communities

The Coconino Plateau exhibits great diversity in extant biotic communities. These biotic communities strongly correlate with elevation, following clines in temperature and precipitation. Geographical dominance of different biotic communities has shifted considerably over time in step with the low and high frequency climatic oscillations described above. At northern low elevations (below 1,219 m or 4,000 ft) Great Basin Desert Scrub dominates consisting primarily of sagebrush, blackbrush and shadscale with assorted xeric grasses dominating. Low elevations in the extreme southern end of the plateau support Semidesert Scrub and Arizona Upland Sonoran Desert Scrub biotic communities. Mixed xeric grasses and herbs, such as gramas; interspersed by agave, yucca and small trees such as mesquite characterize Semidesert Scrub. Arizona Upland Sonoran Desert Scrub consists of a diverse low shrubland of trees and succulents such as paloverde, mesquite, ironwood, catclaw, barrel cactus and chollas. These locations support gathering and hunting, but are marginal for agricultural pursuits.

Plains and Great Basin Grasslands dominate areas of the plateau higher than 1,219 meters (4,000 ft). The central portion of the Coconino Plateau falls within this elevation range and is almost completely dominated by short-grass communities typical of this biotic community.

Interdigitated with Plains and Great Basin Grasslands are areas of Great Basin Conifer Woodland. This biotic community exhibits piñon pine and juniper woodland interspersed by open grasslands, and occurs at elevations between 1,524 meters (5,000 ft) and 2,286 meters (7,500 ft). Generally speaking, elevations tend to be higher towards the edges of the plateau than its center, meaning piñon and juniper woodland surrounds the central grasslands ring-wise. Between 1,524 meters (5,000 ft) and 2,652 meters (8,700 ft) Rocky Mountain (Petran) and Madrean Montane conifer forests dominate the landscape. This biotic community is characterized by mixed conifers such as ponderosa pine, Douglas fir and blue spruce on the higher mountains above 2,438 meters (8,000 ft). Quaking aspen and Gambel oak are also prominent in these areas as well. Gathering opportunities within these biotic communities are excellent, especially within piñon and juniper woodland where fall piñon nut harvests provide a remarkably nutritious food source (Lanner 1981; Sulliven 1992; Janetski 1999). Hunting is also a productive option with many of the larger game species occurring within these communities. The best opportunities for agriculture are found within these higher elevation biotic communities where one finds increased precipitation. Agriculture is not without its challenges though because while moisture increases with elevation, the growing season shortens in kind and local microenviroments have considerable influence on agricultural productivity.

In the southern portion of the plateau below 2,438 meters (8,000 ft) and with adequate precipitation, the landscape is almost completely dominated by pure stands of ponderosa pine. Petran Subalpine Conifer Forest occupies elevations between 2,591 meters (8,500 ft) to 3,658 m (12,000 ft). This biotic community consists of mixed stands of conifers and aspen. Stands of bristlecone pine occur on San Francisco Mountain at 3,352 meters (11,000 ft). Alpine Tundra occurs on San Francisco Mountain above 3,658 meters (12,000 ft) and supports lichens, mosses and herbs. Finally, riparian habitats exhibiting cottonwoods, Arizona walnut, and a variety of aquatic plants occur in areas of permanent water such as springs, seeps and stream segments fed by springs.

The Coconino Plateau supports a variety of fauna representing a wide range of genera, which is itself a reflection of the varied climatic conditions found on the plateau. Notable small genera include a number of rodents such as the white-throated woodrat (*Neotoma albigula*), Gunnison's prairie dog (*Cynomys gunnisoni*), and many reptiles, lizards, and birds such as the western diamond-backed rattlesnake (*Crotalus atrox*) and Merriam's turkey (*Meleagris gallopavo*). Leporids represented by black-tailed jackrabbits (*Lepus californicus*) and three species of cottontail rabbit (*Sylvilagus spp.*) are prevalent. Large grazers include mule deer (*Odocoileus hemiounus*), pronghorn antelope (*Antilocarpa americana*), and historically Merriam's elk (*Cervus canadensis merriami*). Large predators include the North American cougar (*Puma concolor couguar*), American black bear (*Ursus americanus*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), and historically Mexican grey wolves (*Canus lupus baileyi*), Mexican grizzly bear (*Ursus arctos nelsoni*) and the Arizonan jaguar (*Panthera onca arizonensis*). All of the previously mentioned genera would have been economically useful, but to varying degrees. Smaller game animals occur in nearly all previously described biotic communities of plateau, while larger game species cluster in certain communities over others. For instance, large bodied mammals tend occur more often in the grasslands and conifer woodland than the ponderosa forests.

Project Area Ecology

The project area lies within the upper basin of Cataract Creek. The headwaters of Cataract Creek lie ten miles to the south in the foothills of Bill Williams Mountain and flow north-northwest through the southwest corner of Cureton Ranch. Farther north Cataract Creek cuts a deep gorge before discharging into the Colorado River at the mouth of Havasu Canyon. The narrowness of the channel allows only course alluviums to accumulate. Extinct cinder cones of the San Francisco Volcanic Field dominate the landscape and geology within the project area. The project area is centered over one of these cinder cones (Pittsberg) and its associated flows

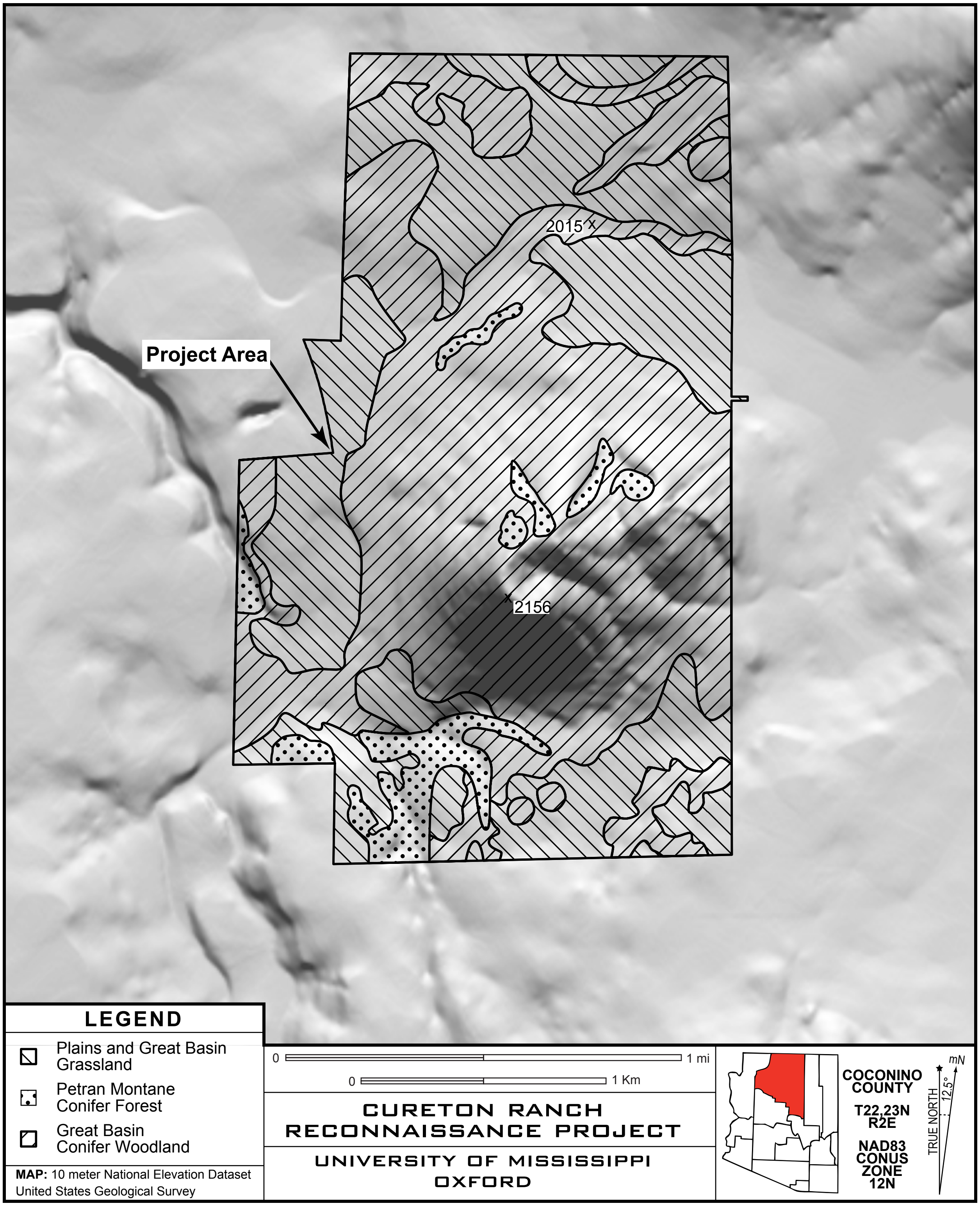

Figure 2.3. Biotic communities within the project area.

which consist of basalt flows and cinder deposits many tens of meters thick overlain by unconsolidated alluvial and colluvial sediments and thin soils.

The project area lies in a transition zone between Great Basin Conifer Woodland and Rocky Mountain (Petran) and Madrean Montane biotic communities (Stitzer and Burtell 2009) (Figure 2.3). Piñon-Juniper woodland covers much of the project area with open grassland interdigitating with Piñon-Juniper woodland at the north and south end of the project area. Pure stands of ponderosa pine lie immediately to the south of the project area. Within the project area ponderosa pine is restricted to stands found along Cataract Creek, the toes of basalt flows issuing from the northern side of Pittsberg, in arroyos dissecting its north slope, and along the southwestern margin of the project area. Alligator juniper and Gambel oak are intermixed with piñon pine and single seed and Utah juniper on the east and south flanks of Pittsberg as well as at its summit. Other economically important plant species noted within the project area include algerita, cliff rose, bitter condalia, banana yucca, Engelmann's prickly pear and pencil cholla. Notable animal species encountered within the project area include elk, mule deer, bald eagle, great horned owl, coyote, cougar, and a variety of rattlesnake species.

Summary

This chapter described the environmental context of the Coconino Plateau and that of the actual project area. The project area encompasses an extinct cinder cone known as Pittsberg, and a portion of Cataract Creek. Climatic aridity arranged into periods of wet and dry of variable length, volcanic geology, and great biotic diversity on the Coconino Plateau are the major environmental themes prehistoric folk adapted to in and around the project area. The information provided in this chapter will assist in understanding which patterns of material culture encountered within the project area are rooted in ecological adaptations and which fall under the purview of sociopolitical analysis.

CHAPTER 3: A BRIEF HISTORY OF COHONINA ARCHAEOLOGY

In this chapter I engage in an examination of the history of archaeological thought on the Cohonina. Potential reasons for taking up this task are numerous, ranging from general inquiries into the production of scientific knowledge to questions concerning the validity or origin of specific archaeological interpretations. This critical examination of archaeological thought on the Cohonina accomplishes two goals specific to this thesis. First, for those committed to archaeology as a scientific project, the specter of relativism dredged up by the processual-postprocessual debates of the 1970s through 1990s was taken as a challenge to develop more robust modes of understanding that can contain relativism. Trigger (2006:531) argues this challenge and the search for solutions is the main reason for the growing interest in the history of archaeology. Thus engaging in a serious historical effort from the perspective of the goals of this thesis stands to reign in the influences of the social milieu in which I and my interpretations exist while simultaneously providing a basis to systematically appraise existing bodies of thought. The value of this approach within Southwestern archaeology is well attested by the success of Downum's (1988) analysis of the history of archaeological research around Flagstaff, Arizona in the context of reassessing the methods of archaeological chronology employed in that region.

Examining the history of Cohonina archaeology also provides a way to assemble the theoretical building blocks needed to accomplish the goals of this thesis while critically assessing theory and explanation rather than simply consuming that which has already been said. In order to account for the specific, but nonetheless complicated, phenomenon of Cohonina forts I must assemble a number of these constructs in order to build an explanatory argument that aspires to illuminate the past as it actually was, rather than how I perceive it. This task has a better chance of success when one understands the origins, successes, and failures of theories employed and how those understandings have changed over time. Indeed, the fort concept predates the formulation of the Cohonina concept and both arose in a particular academic context and were advanced by two charismatic researchers. We ignore these historical details at our peril. Historical inquiry into the methods and modes of knowledge production within Cohonina archaeology also provides a potent antidote to the wasteful effects of disciplinary amnesia and the profound feelings of déjà vu that researchers feel when they return to problems "after long gaps during which what had been learned previously had been forgotten" (Trigger 2006:11).

I begin with a brief outline of Southwestern archaeology. I discuss the genesis and development of the Cohonina concept in relation to broader themes within the discipline. My discussion of these developments takes place in the context of Trigger's (2006:17) thematic approach to the study of the history of archaeology (e.g. culture-historical or processual/postprocessual archaeologies). This approach is capable of tracking the waxing and waning of research strategies that Cohonina archaeology has witnessed, approaches that do not necessarily follow a linear history of development. I next engage in a discussion of recent contributions to Cohonina archaeology that are integral to this thesis and current understandings of Cohonina culture-history, adaptation, and social integration. This final exercise is particularly important because much of this work exists as unpublished Master's theses and archaeological reports emanating from various private and governmental entities, the so-called "grey" and "black" literature of archaeology. I conclude this chapter with a discussion on the development of the Cohonina fort concept and two competing models of Cohonina social organization.

Understanding Archaeology on the Coconino Plateau

The project area as an archeological locality falls within the analytical category of North American archaeology known as the "Southwest". The Southwest as an archaeological concept has its roots in late nineteenth century evolutionary archaeology and the beginnings of culture-historical archaeology. Researchers in the Americas had long been aware of geographic differences in artifact classes that broadly mapped onto different ecological zones (Holmes 1914). This understanding formed the basis for the creation of culture areas that sub-divided North America in an approach similar to that employed by contemporary ethnologists (Trigger 2006:181-2). The Southwest was further subdivided by archaeologists into six principal culture areas corresponding to variable local habitats and the remains of past ways-of-life recognizable as archaeological cultures resulting in the Eastern and Western Anasazi, Hohokam, Patayan, Fremont, and Mogollon concepts (Wilcox 1999:115).

The culture-historical framework developed for this thesis uses the Coconino Plateau and the previously mentioned cultural traditions known to exist in that region as foci in a discussion of prehistoric human occupation in and around the project area. Rather than utilizing the culture-area concept just to talk only about arrangements of material culture through time and space, I use it to inform a discussion of regional systems and how and why they developed and interacted over time. This approach follows a broader effort by some archaeologists in the Southwest and elsewhere to incorporate cultural-historical models – which have been so meticulously developed – into more comprehensive theoretical frameworks that shift the referent from bones, stones, and broken pots to people and their political economies (Renfrew and Cherry 1986; Neitzel 1999; Muller and Wilcox 1999; Trigger 2006:537). This framework incorporates a general chronology applicable to the Coconino Plateau as a region and specific chronologies peculiar to the archeological cultures they describe (Figure 3.1). When it is understood that these concepts are arbitrary divisions in a space-time-cultural continua and that they should not be taken as sharply drawn boundaries or direct reflections of ethnicity, but broad understandings about landscape use, differences in past ways of life, and cultural change; the culture-area concept retains its usefulness as a tool in a macroregional approach that can focus archaeological research at multiple scales (Trigger 2006:311-313).

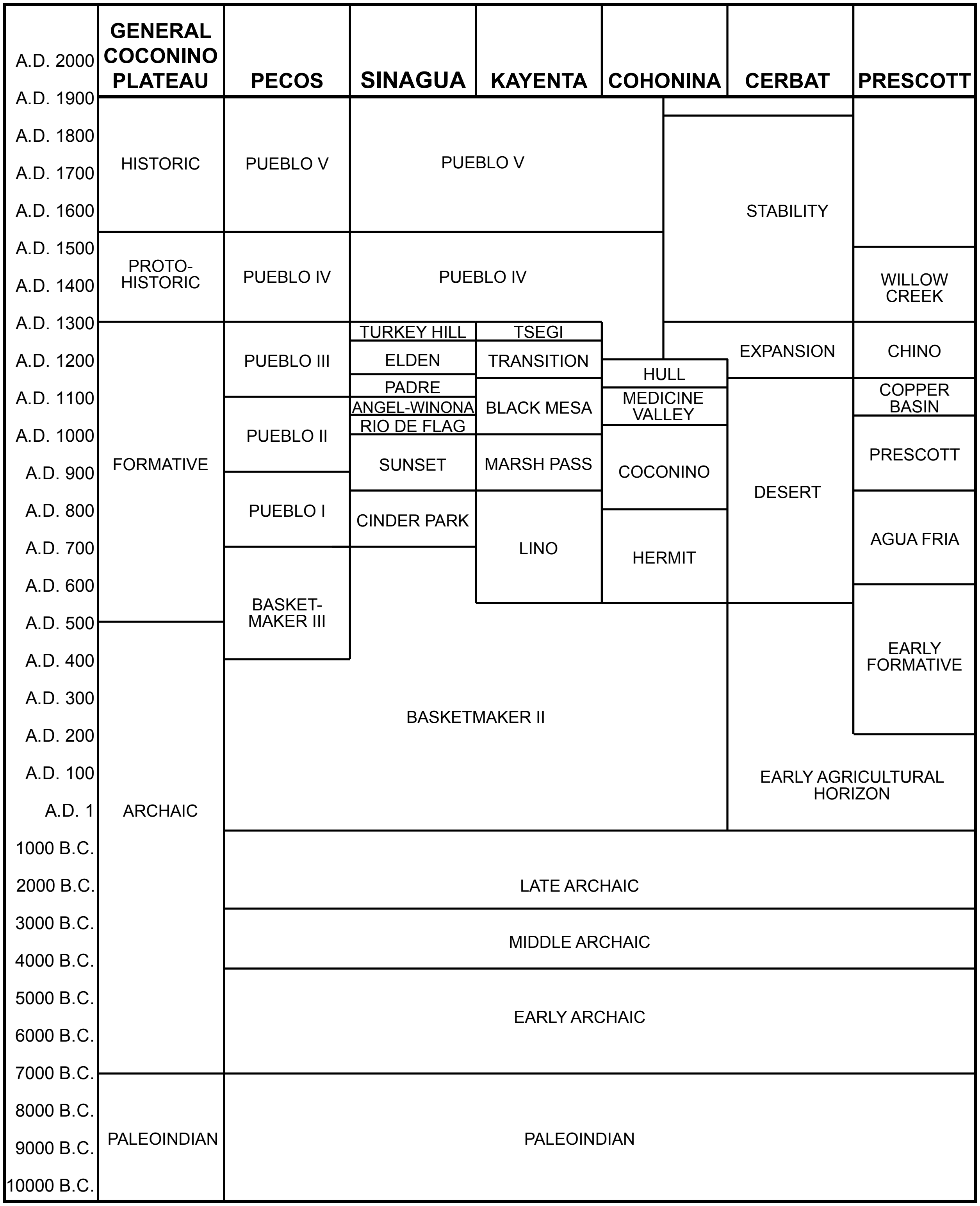

Figure 3.1. General Coconino Plateau chronology and specific cultural sequences.

The Early Period of Cohonina Archaeology

Cohonina in the archaeological literature of the Southwest refers to a pottery making and agricultural folk who occupied the Coconino Plateau of Northern Arizona from about A.D. 550 to 1200 (Hargrave 1937, 1938; Colton 1939, 1946; McGregor 1951, 1967a; Cartledge 1979, 1986; Samples 1992; Schubert 2008; Wilcox 1995). The primary indicator of Cohonina contexts is the presence of San Francisco Mountain Gray Ware. The distribution of this ware on the landscape and its clinal boundaries with other recognized wares (Tusayan Gray Ware [Kayenta], Alameda Brown Ware [Sinagua], Prescott Gray Ware [Prescott], Tizon Brown Ware (Patayan) are taken to represent a Cohonina region and its boundaries (Colton 1946; Garcia 2004; Sorrell 2005). Since this territory matches well with the bounds of the Coconino Plateau (Cartledge 1986:100), I use the latter as a proxy for a Cohonina region. Although it is useful to define the Cohonina region as such, one must keep in mind that the Cohonina shared the plateau with several other groups coming from different cultural traditions, meaning that cultural boundaries do not always follow physiographic ones and those cultural boundaries shifted considerably through time.

The expression of Cohonina material culture in the archaeological record of the Coconino Plateau encompasses the middle Basketmaker III period to the middle Pueblo III period of the Pecos Chronology (Figure 3.1). "Cohonina" as a concept, or archaeological culture, dates to the 1930s and is locatable within the American culture-historical school of thought (Trigger 2006). Currently available evidence suggests the broadest themes of Cohonina history originate with the Basketmakers of the Colorado Plateaus (Lyndon 2005). Thus the Cohonina likely shared a common origin with the Western Anasazi, and likely contributed to the historical development of the modern Hopi (Cartledge 1986; Christensen 2004; Hanson 1999; Schubert 2008; Wilcox 2008).

Defining the Cohonina

The genesis of the Cohonina concept is traceable to Museum of Northern Arizona (MNA) archaeologist Lyndon L. Hargrave (1932) who reported on differences in archaeological material occurring in the area of San Francisco Mountain from that of the Hopi. At the time, these materials were assigned to an as yet to be defined pre-Hopi culture. This and later efforts to define what would become known as the Cohonina were part of a broad culture-historical effort initiated by museum director Harold S. Colton who used the efforts of Harold and Winifred Gladwin (Gladwin and Gladwin 1934) and the findings of the first Pecos Conference (Kidder 1927) to identify and organize prehistoric materials from Northern Arizona (Colton 1932).

The participants of the first Pecos conference developed a general chronology for the Formative period in the Southwest which defines a time when people domesticated crops, developed ceramic technologies, built large villages, and generally settled into a sedentary lifestyle. This pan-regional chronological framework describing successive stages in Southwestern historical development created during the Pecos Conference of 1927 and reported by Alfred Kidder (1927) remains a useful tool when discussing broad themes within the Formative period in the northern Southwest. Not originally tied to calendar years, the “Pecos Classification” evolved into an absolute chronology (Gladwin and Gladwin 1934; Reed 1948; Adler 1996) which is split into two Basketmaker periods and five Pueblo periods. Currently, the beginning of the Formative period on the Colorado Plateaus is marked by the introduction of maize agriculture by 4,000 B.P. (Smiley 2002:40). However, maize agriculture on the Coconino Plateau was established much later, around A.D. 500 (Seymour et al. 2010:25). This difference illustrates a common theme of the Formative Period; that is the considerable variability observed in the timing and location of incipient agriculture in the Southwest. The end of the Formative period is usually placed at A.D. 1300, marking a pan-regional sociopolitical upheaval and reorganization following a period of profound drought in the Southwest.

Colton's major focus early on consisted of compiling trait lists based on artifact classification, especially ceramics, and then placing those findings within the Pecos Classification and the Gladwins' cultural taxonomy (Colton 1939). Pottery styles were seen as sensitive indicators of cultural variation (Trigger 2006:298) which could be used to identify and track past groups of people spatially and temporally. The practice in the Southwest is traceable to Alfred Kidder who demonstrated the usefulness of ceramic analysis in his investigations at the Pecos Pueblo (Kidder 1962[1924]; Trigger 2006). Out of this effort, Hargrave (1932) published definitions of forty pottery types encountered during the museum's early survey work. Three of those types (Deadmans Gray, Deadmans Black-on-grey, and Deadmans Fugitive Red) that were grouped with the previously mentioned pre-Hopi culture would later be attributed to the Cohonina.

In 1937 Hargrave defined the Cohonina as an archaeological culture in its own right based on survey and excavations around San Francisco Mountain (Hargrave 1937). The term "Cohonina" was adapted from a Hopi term "Koninam" which refers to the Yuman speaking Upland Pai folk that occupied the Coconino Plateau at the time of European contact (Hargrave 1938; Colton 1939; Spicer 1962). The choice of a Hopi term referring to their western neighbors carried with it the expectation that archaeological remains ascribed to the Cohonina would prove to have direct historic links to extant native groups occupying the same region.

Hargrave used ceramic technology to define the Cohonina as a culture unit with temporal and spatial boundaries. He argued that the Cohonina could be identified by grey ware ceramics constructed using the paddle-and-anvil method and fired in a reducing atmosphere. Hargrave used this ceramic data to suggest that the spatial boundaries of the Cohonina included nearly all of northwestern Arizona south of the Grand Canyon. He also dated the Cohonina to the Pueblo I through the Pueblo III period. He also proposed the Cohonina were a sub-culture or a "stem" in Gladwins' (1934) cultural taxonomy, belonging to the "Yuman Root". This construction placed the Cohonina within a desert adapted cultural complex thought to have diffused north from Mexico via the Colorado River Valley.

The 1938 Museum of Northern Arizona Expedition to Sites North of Williams, Arizona

Hargrave headed a MNA expedition to the upper reaches of the Cataract Creek Drainage Basin beginning in the spring of 1937 and completed during the summer of 1938. This expedition targeted the heart of the grey ware zone in hopes of delineating the spatial and temporal extent of the newly defined Cohonina stem (Downum 1988:136). Work was conducted near Ponderosa forest and well away from the frontier zone in the area east of San Francisco Mountain where folk coming from Anasazi, Mogollon, and Hohokam traditions were thought to have interacted. It was hoped that by doing so the expedition would recover dateable wood and avoid the confounding effects of overlapping cultural complexes. Hargrave used the newly defined San Francisco Mountain Gray Ware (Colton and Hargrave 1937) which included the previously known Deadmans Gray, Deadmans Black-on-grey, and Deadmans Fugitive Red to identify sites thought to be purely Cohonina. The resulting publication (Hargrave 1938) refined the definition of the Cohonina based on those newly refined ceramic types and the expedition's excavation results. Those results are also an integral component to the major goals of this thesis and therefore justify a detailed discussion of the expedition itself and the data it produced

In October of 1937 Colton and Katharine Bartlett recorded two sites 5 miles north of Williams, Arizona and ½ mile west of Highway 89 (now Highway 64). During the spring of the following year Hargrave and Sara J. Tucker along with a local informant (George Davis) conducted causal survey in the area of Sections 2, 3 and 4, Township 22 North, Range 2 East, Gila & Salt Rivers Baseline & Meridian, but also ranged to the north and east from that location. During the summer of 1938 Hargrave returned with a crew of seven including Albert H. Schroeder, Walter W. Taylor, Robert R. Solenberger, Milton Wetherill, two unnamed Hopi laborers, and an unnamed cook. Museum of Northern Arizona archives reveal the expedition and the work leading up to it recorded a total of 28 archaeological sites north of Williams. Site location maps maintained by the MNA reveal survey was carried out in at least ten separate locales (Figure 3.2).

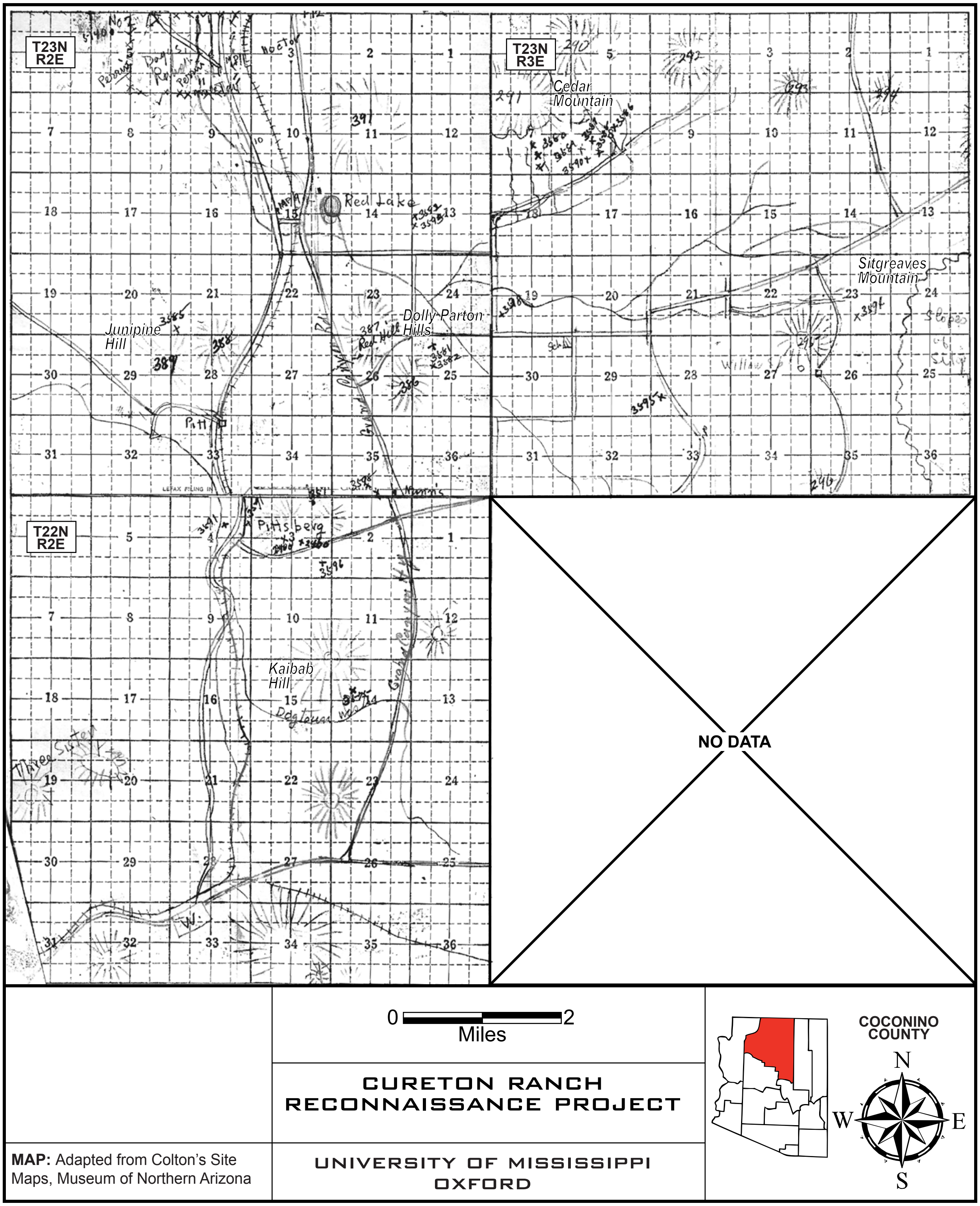

Figure 3.2. Sketch map of sites recorded during the 1938 MNA expedition.

Note: townships, ranges, and contemporary place names are included in the figure for reference.

The 1938 expedition's work around Pittsberg falls within the current project area. Nine sites were recorded around Pittsberg, four of which were excavated (Table 3.1). However, the expedition focused most of its efforts on excavating a collection of structures that was later dubbed the "Pittsberg Village" (NA3577). According to maps published at the time (Figure 3.3), this site includes two large pit houses (Structures C and D), a narrow masonry and jacal struc-

Table 3.1. List of sites recorded just prior to or during the 1938 MNA expedition.

Site Number	Nearby Feature	Date Recorded	Description
NA2400	Pittsberg	10/7/1937, Colton	brush huts
NA2460	Pittsberg	10/7/1937, Colton & Bartlett	several pithouses
NA3574	Pittsberg		flake scatter
NA3575	Kaibab Hill		masonry 2 rooms
NA3576	Pittsberg		depression
NA3577	Pittsberg	6/13/1938, Schroeder	fort
NA3578	Red Lake Valley	1938, Taylor	rock outline, 2 mounds
NA3579	Cedar Mtn.		rock outline, 1 room
NA3580	Cedar Mtn.	1938, Taylor	rock outlines, depressions
NA3581	Dolly Parton Hills	1938, Taylor	sherd area
NA3582	Dolly Parton Hills	1938, Taylor	rock outline, sherd area
NA3583	Peach Springs		
NA3584	KY Canyon	7/19/1938, Schroeder	rockshelter
NA3585	Junipine Hill	7/19/1938, Schroeder	sherd area
NA3586	Cedar Mtn.	1938, Taylor	sherd area, terrace
NA3587	Cedar Mtn.	1938, Taylor	sherd area, deppressions
NA3588	Cedar Mtn.	1938, Taylor	sherd area, deppressions
NA3589	Cedar Mtn.	1938, Taylor	sherd area, deppressions
NA3590	Cedar Mtn.	1938, Taylor	sherd area, terrace
NA3592?	Red Lake Valley	1938, Solenberger & Wetherill	sherd area
NA3593?	Red Lake Valley	1938, Taylor	sherd area
NA3591	Pittsberg	7/9/1938, Wetherill & Schroeder	rockshelter
NA3594	Willow Spring	1938, Taylor	Plaza
NA3595	Willow Spring	1938, Taylor	cave, brown ware
NA3596	Pittsberg	8/1/1938, Schroeder	sherd area
NA3597	Pittsberg	8/5/1938, Wetherill	Petroglyph
NA3598	Pittsberg	8/5/1938, Colton, Hargrave, & Schroeder	sherd area
NA3599	Sitgreaves Mtn.	5/12/1938, Wetherill	artifact scatter

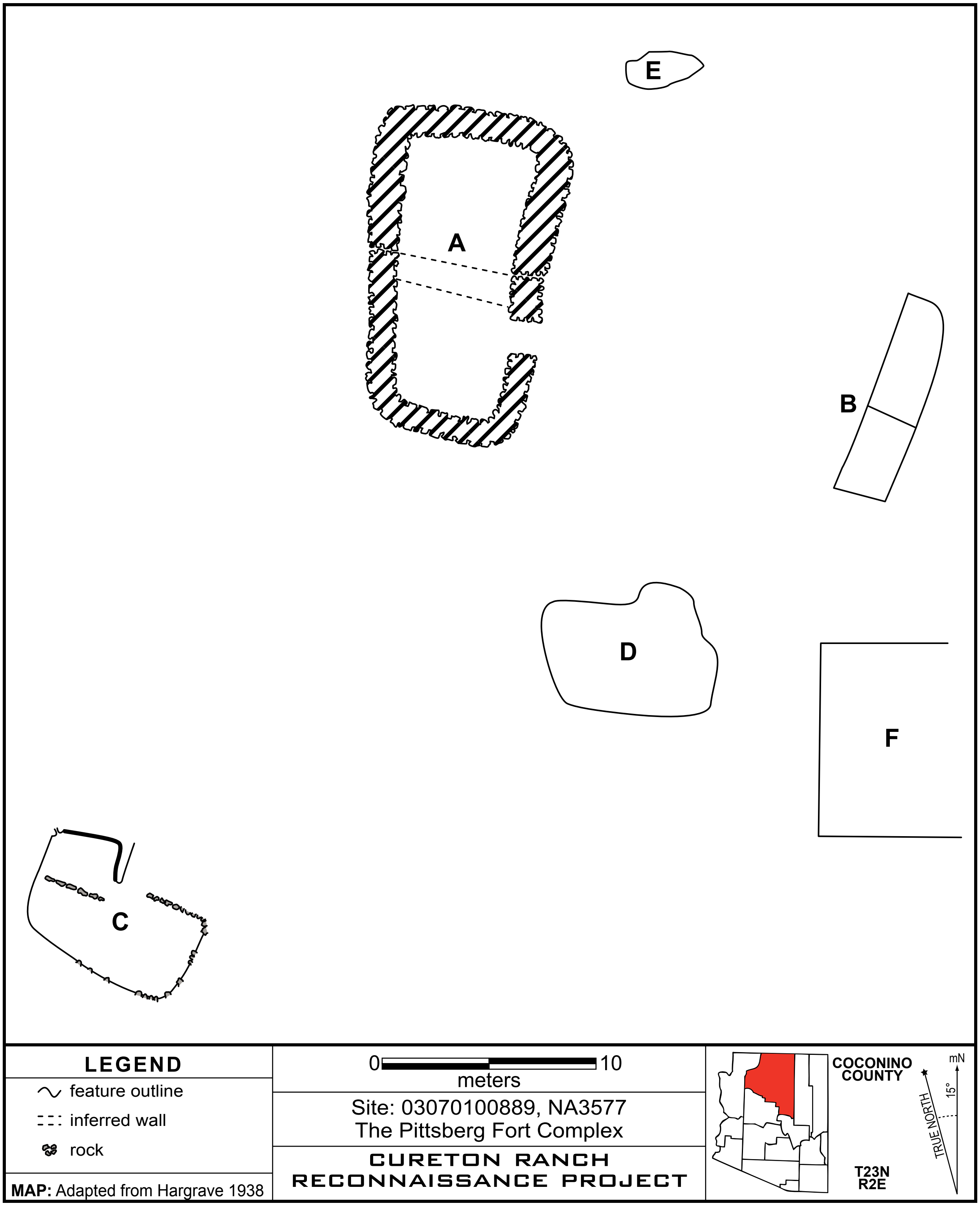

Figure 3.3. Map of NA3577.
This map appeared in Hargrave's (1938) short report on the 1938 MNA expedition.

ture (Structure B), a thick walled masonry structure known as a “fort” (Structure A), and two undescribed and rather enigmatic features (E and F).

Detailed descriptions of excavation methods used at Site NA3577 and the others around Pittsberg do not exist, but it is possible to reconstruct some of their methodology from MNA archives. The entire site was mapped using magnetic north (15°E in 1938), although the published figures and maps seem to indicate true north was used. The excavators focused only on the interiors of structures and apparently did not consistently excavate in natural or arbitrary levels. However, they did attempt to leave floor assemblages in place and made special note of artifacts recovered less than six inches above the floor. They made a distinction between those artifacts found above and below roof material as well. They also excavated the structures utilizing 1m by 1m grid squares. Although they screened room fill, no record exists detailing the mesh size of their screens. Schroeder produced floor assemblage maps, which include dendrochronological samples recovered, for Structures A and C, but not B, E, and F. He produced a floor plan map for Structure D which includes post holes and wood planks, but not artifacts; although MNA artifact inventories suggest a floor assemblage existed.

The excavators took at least 65 photographs of the site throughout the course of the excavation. The subjects range from photographs of general site settings, to whole structures, to architectural details, to photographs of in situ artifacts. Museum of Northern Arizona archives lists 472 artifact specimens associated with the excavation of NA3577. This includes ceramics (whole vessels and thousands of sherds), chipped stone, groundstone, bone tools, cordage, fabric, food items (maize [Zea mays], beans [Phaseolus sp.]), and a manuport (crinoid fossil). Approximately 150 dendrochronological samples were also recovered from Structures A, B, C, and D. A single burial, interred in a flexed position on their side, was also encountered within Structure A.

The expedition was a success in that it secured several tree ring dates from excavated sites thought to be pure Cohonina contexts. Site NA3577 provided the bulk of this material as well as providing a wealth of information on Cohonina material culture. Hargrave used the findings from this expedition to restrict the Cohonina culture as dating from about A.D. 700 to about A.D. 1115 (Pueblo I to early Pueblo III) and occupying the entirety of northwestern Arizona. He described these folk as practicing an equal combination of gathering, hunting, and agriculture, residing in "earth lodges", and producing a distinctive "Cohonina" projectile point. He placed the Cohonina within the "Patayan" cultural root which Colton (1939) would later argue should replace Gladwin's linguistically defined "Yuman Root".

The First Cohonina Synthesis

In 1939 Harold Colton published a synthesis of Northern Arizona survey and excavation (Colton 1939). His aim was to organize the archaeological record thus far revealed into culture units placeable within the Gladwins' cultural taxonomy. Colton codified the Cohonina concept in that publication when he gave it new spatial boundaries, provided a Cohonina specific chronology, and created a list of cultural traits that define Cohonina contexts. He restricted the Cohonina spatially to an area closely matching the bounds of the Coconino Plateau based on a more detailed understanding of the distribution of San Francisco Mountain Gray Ware. Colton also created a Cohonina chronology consisting of "Coconino" (A.D. 700 to 900) and "Medicine Valley" (A.D. 850 to 1100) foci. Colton fully explained the basis for replacing the Yuman root with his Patayan one, arguing that assigning an archaeological culture a language name for an extant group (Yuman in this case) implied cultural links that were yet to be demonstrated. He defined the Patayan root as a hunter-gatherer desert people who later took up flood agriculture and occupied the Colorado River Valley, but jettisoned the untested assumption these river people were Yuman speakers. Colton seconded Hargrave's determination that the Cohonina were a branch belonging to the Patayan root, relying on the same ceramic data used by Hargrave (Colton 1939:22-31).

Colton's use of the Gladwins' taxonomic system and "foci" to define chronological blocks requires some explanation. Colton (1939:5-10) used foci in his culture-historical analyses because of his desire to reconcile the Gladwins' so called Southwestern Method with the contemporaneous Midwestern Taxonomic Method (McKern 1939). Colton defined foci as recurring arrangements of material culture, interpretable as traits in a localized cultural system of relatively short duration. Thus foci describe the geographic, temporal, and cultural aspects of material culture complexes at a small scale, i.e. the "site". Components consist of manifestations of a particular focus at a given site exhibiting multiple foci. Identifying the relative age and percentage of shared traits between foci established linkages that allowed their arrangement into branches. Branches link to roots as time depth and geographic extent increase, and shared traits become more basic. The use of foci in Cohonina archaeology has persisted while the concept has fallen out of use in other regions of the Southwest where the "period" or "phase" concept is now preferred. The confusion resulting from this persistence have led some researchers to hint at (Sorrell 2005; Schubert 2008; Seymour et al. 2010:28) or explicitly try to (Schwartz 1955; Cartledge 1986) jettison the foci concept in favor of phases in Cohonina research. With regards to this thesis, carrying the use of foci through the discussion of early Cohonina archaeology will avoid confusion. I will make explicit use of "phases" (Willey and Phillips 1958:21-22) later in this chapter and in subsequent ones discussing the regional Cohonina chronology used in this thesis. It is my hope that by doing so I will help to bring Cohonina research into line with the rest of North American archaeology.

Colton's (1939:25-29) list of cultural traits that define Cohonina contexts consisted of traits falling into three categories: portable material culture, subsistence scheme, and architecture. He upheld San Francisco Mountain Gray Ware as the indigenous pottery for the Cohonina as well as Hargrave's (1938) "Cohonina" projectile point. Various other portable objects such as metates, manos, axes, bone awls, basketry, and wood items were described. Colton listed known Cohonina food items as "corn and game", implying a mixed economy based on hunting and agriculture.

Colton also described Cohonina architectural technology in terms of four functional classes: shallow earth lodges, deep pit houses, surface granaries, and forts. All of these architectural classes used earth, timber, jacal, and unshaped masonry as building materials, but to varying degrees. For example the earth lodges made more use of earth and timber whereas surface granaries were built of low masonry foundations and jacal walls. Colton, along with Hargrave (1938), used the presence of firepits or hearths to infer a domiciliary function for the first two classes. Granaries were labeled as such because their small individual room size and lack of firepits suggested storage. Finally, Colton briefly described forts as rectangular masonry buildings positioned on hilltops.

A Second Cohonina Synthesis

Gladwin (1944) produced a critique of Colton's first synthesis in a broad scale attack on the MNA school of archaeology and the Douglas method of dendrochronology. That critique undermined Colton's chronology and called into question the validity of some of his cultural "branches", including the Cohonina. In 1946 Colton responded directly to Gladwin's criticisms when he published *The Sinagua*, a book length synthesis of the MNA's previous twenty-five years of archaeological research in Northern Arizona. *The Sinagua* is an expansion of Colton's earlier 1939 analysis, the bulk of which consists of 170 some odd descriptions of excavated sites focused on architectural details and ceramic analysis. He used these data to refine the methods of analysis, especially ceramic, that formed the basis of his cultural-historical framework. While the book focuses on reconstructing a history of the Sinagua, an archaeological culture located in the southeastern corner of the Coconino Plateau, it does provide a benchmark synthesis of Cohonina archaeology to that point as well as the first quantified Cohonina Chronology based on Colton's "pottery complexes" comprising "index wares" and "ceramic groups".

In *The Sinagua* Colton reaffirmed his argument that folk of the past could be identified by the pottery they made, used, and left behind in the archaeological record. He elaborated on this notion by suggesting that it was the unpainted utilitarian wares (cooking and storage vessels), what he called "index wares" that are the most robust indicators of cultural affiliation because they were less likely to move about the landscape via trade or otherwise (Colton 1946:18, 23-32). Thus Colton used the distribution of an index ware on the landscape to represent the approximate territory of the people that produced it. In the case of the Cohonina, San Francisco Mountain Gray Ware (Deadmans Gray and Floyd Gray are the utilitarian types) was upheld as an index ware for that archaeological culture and its distribution upheld previously formulated notions of a Cohonina culture area.

Colton altered his stance on the placement of the Cohonina within his cultural taxonomy based in part on the defining characteristics of San Francisco Mountain Gray Ware. He acknowledged broad similarities between San Francisco Mountain Gray Ware and Tusayan Gray Ware (associated with the Kayenta Anasazi) which included the mutual use of reduction firing, sand temper, coil-and-scrape in conjunction with paddle-and-anvil construction, burnishing, and the application of a fugitive red slip to vessel exteriors (Colton 1946:28-29). In an earlier publication, Colton (1945) backed off from associating the Cohonina with the Patayan root thinking that not enough information was available to support such an association. In *The Sinagua* he backed off completely from assigning the Cohonina to any root at all. While it is not explicitly stated, the similarity of San Francisco Mountain Gray Ware to Tusayan Gray Ware and the use of masonry architecture, and the status of the Patayan concept being a sort of catchall category at the time must have led Colton to question the validity of placing the Cohonina branch within the Patayan root.

The second component of Colton's pottery complexes are "ceramic groups" which are defined as assemblages of contemporary and temporally sensitive ceramic types (usually decorated) encountered at the site level of analysis (Colton 1946:18-23). These ceramic groups formed relative ceramic chronologies based on stratigraphic relationships. Relative ceramic chronologies became absolute chronologies by coupling dendrochronological dates from individual pieces of wood expressed in years of the current Christian epoch to directly associated ceramic assemblages. By linking absolute dates to ceramic groups, ceramic sherds become a powerful chronological tool because of their ease of use and applicability to sites without dateable wood. Colton identified two decorated types of San Francisco Mountain Gray Ware: Deadmans Black-on-grey (in either the Kana'A or Black Mesa styles) and Deadmans Fugitive Red, but the identified date ranges for these types (on the order of 400 years) made them of little use as types within ceramic groups. Given this state of affairs, Colton used ceramic groups comprised mostly of Tusayan White Ware, Tusayan Gray Ware, San Juan Red Ware, and Tsegi Orange Ware to date sites identified as Cohonina. However, a steadily expanding tree-ring database derived from archaeological contexts requires archaeologists to continually revise date ranges for specific tree-ring dated ceramic types before their inclusion in any analysis. On a mundane level, low percentages of Kayenta Wares relative to San Francisco Mountain Gray Ware at many Cohonina sites makes it impossible to estimate tight dates using ceramic groups made up of intrusive types.

Colton was well aware of these issues and devoted much effort in *The Sinagua* to addressing methodological challenges in tree-ring dating and ceramic analysis. These meditations allowed Colton to strengthen the existing Cohonina chronology. His updated chronology retained the Coconino (A.D. 700 to 900) and Medicine Valley (A.D. 900 to 1100) foci while adding a late Hull focus (A.D. 1100 to 1200). Colton defined the Coconino focus as a period in which the Cohonina constructed shallow pit habitations in loose arrangements. The following Medicine Valley focus characterizes a period when the Cohonina began building forts along with above ground granaries associated with shallow pit houses. Finally, Colton added a terminal Hull focus to the Cohonina chronology and defined it as a period of masonry pueblo construction.

Exploring Cohonina Culture-History

With the Cohonina concept on a solid foundation incorporating a chronology, list of cultural traits, and general patterns of change, the MNA turned its attention west towards the supposed Cohonina core. The work of the MNA identified a frontier zone east of San Francisco Mountain where Cohonina, Kayenta, and Sinagua cultures interacted to a great degree. This complicated archaeological context made it difficult for Colton to further his culture-historical program of research. In 1938 Lyndon Hargrave excavated sites west of this zone in hopes of identifying "pure" contexts that could aid in fleshing out Cohonina prehistory. Longtime MNA collaborator John C. McGregor out of the University of Illinois restarted this effort in 1949. He directed excavations north-northeast of Redlake, Arizona, six kilometers north of the current project area and at Red Butte, just south of the Grand Canyon (McGregor 1951).

Two years later McGregor (1967a) directed an expedition to the area of Mt. Floyd fifty kilometers west-northwest of the current project area, the results of which went unpublished until 1967. This research program elaborated on the distribution of San Francisco Mountain Gray Ware, Cohonina architectural details, defining the degree of Cohonina mobility and seasonality, and what manner of economy the Cohonina engaged in. Underlying these research interests was a broader culture-historical agenda aimed at examining Cohonina origins. McGregor hoped to determine Cohonina cultural affiliation to one of the principal Southwestern cultural divisions, namely the Patayan or Western Anasazi. He also wanted to examine the viability of supposed Cohonina historic connections to extant Upland Pai folk.

Perhaps the most important contribution coming out of the McGregor expeditions has to do with his efforts to outline a Cohonina architectural tradition. He demonstrated that the Cohonina had a long tradition of surface or near surface construction techniques that he saw as falling into one of four categories: brush huts, ramadas, patio or alcove houses, and the fort and long room combination (McGregor 1951:124-126). Brush huts were ephemeral structures lacking hearths, sometimes with prepared floors, but lacking definite pole supported construction. Ramadas consisted of open sided structures, having stout flat roofs (sometimes clay covered) and lacking hearths or fire-pits. They were constructed using moderately heavy timbers, the roofs of which were sometimes used as work areas. The patio or alcove house consisted of a rectangular room lacking an interior hearth attached to a more open ramada with a fire-pit. These structures exhibit jacal construction supported by a masonry foundation of variable height. McGregor elaborated upon the Cohonina fort described earlier by Hargrave and Colton in his 1951 publication by adding the "long room" to the list of traits defining forts, but declined to challenge Colton's defensive interpretation of Cohonina forts. In his final analysis McGregor saw little evidence of change in Cohonina architectural technology and identified all of his architectural types as either work related, residential, or a combination of the two. He did not identify any structure as communal, public, or ceremonial.

McGregor gave the economic base of the Cohonina healthy attention in his attempt to define aspects of Cohonina social organization. Colton and Hargrave assumed from the start that the Cohonina practiced some combination of gathering, hunting, and agriculture, but did not explore the issue further (Hargrave 1938; Colton 1939, 1946). They also assumed long term trade relations existed between Cohonina, Sinagua, and Kayenta folk based on the wide spread distribution of decorated ceramic wares, but did not pursue this line inquiry to other mediums of exchange. The McGregor expeditions gathered some evidence of Cohonina agricultural practices and limited evidence of gathering, hunting, and trade. McGregor proposed that the Cohonina engaged in a seasonal round that took them from high to low elevations during the winter and back during the summer. He relied on ethnographic analogy to make this argument by pointing to the historic Havasupai's seasonal round in the same region. He also cited a lack of hearths in some structures, and periodic remodeling in others as evidence the Cohonina favored warm weather conditions (McGregor 1951:141, 1967a:126).

When McGregor turned his attention to the problem of Cohonina origins and historical connections he attempted to establish linkages to the Patayan tradition and to that of the extant

Upland Pai folk, especially the Havasupai. McGregor argued that Cohonina history is ultimately traceable to the Colorado Delta and cited a dearth of personal ornamentation, substantial masonry architecture, deep pit houses, public architecture, inhumation burials, and (curiously enough) he cites Colton (1946) in support of his argument despite Colton's ambivalence on the matter (McGregor 1951:23-24,147-148; 1967a:1-2,110,120). McGregor also argued in the Mt. Floyd volume that the modern Havasupai are the most likely descendents of the Cohonina (McGregor 1967a:115). His conclusion mirrored that of Douglas Schwartz who claimed to have found ceramic and architectural evidence of Cohonina-Havasupai connections in Lower Cataract Canyon (Schwartz 1955). However, Robert Euler (1958) argued that Upland Pai (Hualapai and Havasupai) origins lie with the Cerbat culture (500 B.C. to A.D. 1850) of the Patayan root, not with the Cohonina. These culture-historical problems became the focus for a synthetic push in Cohonina archaeology after McGregor finished the 1951 field season near Mt. Floyd, Arizona.

Culture-Historical Syntheses

Cohonina archaeology was the focus of several attempts at synthesis in the period between McGregor's 1951 expedition to Mt. Floyd, Arizona and the initiation of cultural resource management on the Kaibab National Forest in the mid 1970s. All of these efforts were part of broader syntheses that examined all of Northern Arizona archaeology or all of Southwestern archaeology. All of the contributors to this synthetic push were preoccupied with culture-historical problems revolving around classificatory schemes for artifacts and cultures, and the working out of cultural chronologies which attempted to link cultural origins embodied in concepts like "Patayan" and "Anasazi" to recorded history in the Southwest after A.D. 1541.

The debate over which principal Southwestern cultural division the Cohonina concept should belong to stabilized by the late 1950s when Colton's (1939) placement of the Cohonina in the Patayan root shifted from tentative to assured, mostly out of efforts made by McGregor

(1951). However, Albert Schroeder (1957) placed the Cohonina within his new “Hakataya” principal cultural division. He argued this tradition originated out of a basic Archaic desert tradition which assimilates the entire Patayan root and Cohonina by extension. However, he did little to demonstrate a solid basis for doing so in his original publication (Schroeder 1957) or later iterations (Schroeder 1979 for example).

In 1960 Colton published a short synthesis of Northern Arizona archaeology titled *Black Sand*, in which he discussed the Cohonina. Like previous publications (Colton 1945, 1946), Colton declined to link the Cohonina concept to one of the principal Southwestern cultural divisions in *Black Sand* or in his contemporaneous ceramic manual that describes the Cohonina ceramic tradition (Colton 1958). In 1963 Robert Euler summarized archaeological work in Northwestern Arizona in terms of the several culture areas then identified and proposed new avenues for future research. Like Colton, Euler declined to link the Cohonina to any so called cultural “root”. In 1966 Douglas Schwartz produced a synthesis of Northern Arizona archaeology focused on the Grand Canyon and set within a culture-historical framework. He tracked the historical development of the Archaic Desert Culture, Anasazi, and Cohonina concepts and argued the Cohonina belong to the Yuman/Patayan cultural tradition originating in the Colorado River Valley (Schwartz 1966:120). John McGregor’s 1967 second edition of *Southwestern Archaeology* represents the last attempt at a Cohonina synthesis from this period. In that volume, McGregor maintained his argument that the Cohonina concept belongs with the Patayan root, pointing only to similarities in ceramic technology in support of that argument (McGregor 1967b:23).

Archaeologists failed to reach a consensus regarding a Cohonina specific chronology during this period. This lack of agreement manifests in the use of the Pecos Chronology or generic periods described in absolute years in discussions of Cohonina development. Colton, Euler, Schwartz and McGregor dated the Cohonina from about A.D. 700 to 1150, give or take a half century on either end (Colton 1960:59; Euler 1963:83; Schwartz 1966:479; McGregor 1967b:249, 377; Schroeder 1979:105-106). However, Colton’s (1958) ceramic manual maintained his 1946 chronology with the addition of McGregor's (1951) Naylier focus, which dated the Cohonina from A.D. 500 to 1200 and split into four foci.

The debate over what became of the Cohonina in the period after A.D. 1200 intensified during this period. Schwartz (1955) made an early effort to establish links between the Cohonina and the extant Havasupai now occupying the lower Grand Canyon. McGregor and Colton actively supported this thesis, but had considerable difficulty in marshalling evidence in its favor. Schwartz maintained his argument for a Cohonina-Havasupai historical connection in his 1966 synthesis citing the apparent overlap in territory and Havasupai oral traditions claiming ancestral connections to ruins around San Francisco Mountain (Schwartz 1966:478-479). Robert Euler (1963:83-84) was the major dissenter in that debate. He rejected Schwartz's thesis and insisted the Cerbat culture of Western Arizona displaced the Cohonina after A.D. 1300 and eventually became the historic Upland Pai. Euler cited his 1958 dissertation to support his argument which documented that more similarities are apparent between Cerbat and Upland Pai material culture than Cohonina, Cerbat occupations overlie Cohonina ones at multi-component sites, and that a considerable gap exists between the latest identifiable Cohonina site (ca. A.D. 1200) and the earliest evidence of an ethnic group identified as the Havasupai (ca. A.D. 1600).

The reservations that most of these researchers had when discussing Cohonina origins in relation to concepts like Patayan and Anasazi betrays the beginning of an important shift in attitudes within the discipline of archaeology as a whole and Cohonina archaeology specifically. By the early 1960s, North American archaeologists were aware of the limits of the culture-historical approach's ability to explain change in the archaeological record and began scaling back interpretations and the building of grand narratives. In the Southwest, research increasingly focused on the internal history of archaeological cultures and the searching out of historical antecedents to existing Native American groups currently occupying that region.

In the efforts of Schroeder, Euler, Colton, Schwartz, and McGregor to reconstruct Cohonina history one can see the operation of the two primary mechanisms for change in culture-historical theory: migration and diffusion. The use of these often intertwined concepts by North American archaeologists is rooted in their commitment to historical particularism and skepticism of evolutionary models (Trigger 2006:308). The somewhat contradictory combination of historical particularism's opposition to evolutionary models developed in the Nineteenth century and latent racism embodied in negative attitudes towards Native American innovative ability, resulted in archaeologists invoking migration and diffusion as the only explanation for change evident in the archaeological record. The environment-human interface was always seen as mechanism of change in the Southwest, but this too was couched in terms of migration and diffusion (Downum 1988:191). This type of theoretical formulation played out in typical fashion within Cohonina archaeology. Cohoninas were theorized as wandering migrants possessing a complete, but very rudimentary, cultural package before settling down on the Coconino plateau. In the course of settling down, they become passive receivers of cultural innovations from neighboring groups, which in turn were considered ultimately traceable to the assumed cultural font of Mesoamerica.

Change in the Cohonina archeological record was explained as the cumulative reception of cultural traits from neighboring groups, all of which rested atop a cultural core received elsewhere in their deep past. Schroeder's cultural evolution embodied in the Hakataya concept lacks mechanisms of change other than small appeals to migration and diffusion, and the concept actually stresses similarity rather differentiation in the archaeological record. Migration played a major role in Euler's view of Upland Pai history, in which the Cohonina play a passive role as territorial capitulators. Euler saw diffusion emanating from the more culturally vigorous Anasazi as a confounding veneer that ought to be removed before any real understanding of the Cohonina could be attempted. Colton's and by extension the entire MNA's explanatory framework revolved around the dual processes of migration and diffusion. His "black sand" land-rush theory is migration writ large. In his analysis of the Cohonina-Sinagua-Kayenta shatter zone, he sees constant interaction between disparate groups in the post-eruptive years leading to admixture and the emergence of new cultural forms. Schwartz invoked migration to explain where the

Cohonina came from (the Colorado River Valley) and diffusion (from the Kayenta Anasazi) to explain the nature of Cohonina material culture, although he seemed to understand that adaptation may play a key role in the formation of cultural systems. Finally, McGregor's *Southwestern Archaeology* is a tour de force of migration-diffusion theorizing that had the chronically peregrinate and culturally crude Cohonina receiving the benefits of agriculture and all things refined from the Anasazi.

The search for ethnicity in the archaeological record that preoccupied archaeologists working in Northern Arizona had run aground by the late 1960s. Willey and Phillips (1958:48), had already recognized the near insurmountable difficulties of pinning down ethnicity in the archaeological record, but this did not stop researchers from trying even though the ethnic significance of the Cohonina concept was showing signs of weakness. This is evident in Euler's basic challenge to the Cohonina-is-Havasupai theory maintained by Schwartz, McGregor, and Colton. It is telling that neither camp could prevail at the time and that Schwartz was the only one besides Euler who appeared to think something was amiss. Although McGregor was fully committed to a culture-historical position, he inadvertently revealed weaknesses in that approach by equating Cohonina with some kind of unified ethnicity. For example, he acknowledged that Cohonina boundaries were not sharply drawn, but existed as clines between recognized archaeological cultures (McGregor 1967b:248-250) while simultaneously insisting the Cohonina were a distinct ethnic group.

Trigger (2006:309), citing Renfrew (1978), points out that these situations make delineating archaeological cultures highly subjective, opening them up to manipulation in accordance with interpretive agendas. Indeed, archaeologists associated with the MNA exhibited a peculiar devotion to demonstrating the Cohonina were a peripheral and backward set of folk unrelated to the Sinagua or Kayenta by accentuating perceived differences and ignoring prevalent overlaps in material culture (Hargrave 1938:48; Colton 1939:27, 1946:274; Schwartz 1966:479; McGregor 1967a:134, 1967b:306-307). These shortcomings of the culture-historical school of thought became pronounced by the late 1960s as the "New Archaeology" made inroads to Northern Arizona and the importance of archaeological research emanating from the Museum of Northern Arizona declined (Downum 1988:251-253). Pure research driven archaeological projects were giving way to cultural resource management associated with federally administered public lands and projects receiving federal funding. A concomitant renewal of interest in processual change, ecology, and settlement systems analysis pushed researchers working in Northern Arizona to reassess Cohonina archaeology and suggest new lines inquiry.

Processualism and Cohonina Archaeology

After 1970 new research in Cohonina archaeology shifted away from the Museum of Northern Arizona (MNA) and its various collaborators to the Kaibab National Forest (KNF) and Northern Arizona University (NAU). A major impetus for this shift was the expansion of cultural resource management (CRM) on the Coconino Plateau driven by U.S. Forest Service efforts to comply with the mandates of the National Historic Preservation Act of 1966 (NHPA). The results of these efforts, which are ongoing, are a major component of this thesis; meaning it is worth discussing their source (the KNF) and structure (as a Geographic Information System) in detail.

The Kaibab National Forest and its Heritage Database

The Kaibab National Forest is located in north central Arizona and is comprised of three discontinuous districts known as the Williams, Tusayan and North Kaibab districts moving from south to north (Figure 3.4). Several federal acts and orders are responsible for the production of KNF archaeological data in that they provide the Forest Service with stewardship responsibilities for historic resources located within its administrative boundaries. These include the previously mentioned NHPA (particularly Sections 106 and 110), the National Environmental Policy Act of 1969 (NEPA) and the Preserve America Executive Order of 2005 (Jarvis 2008).

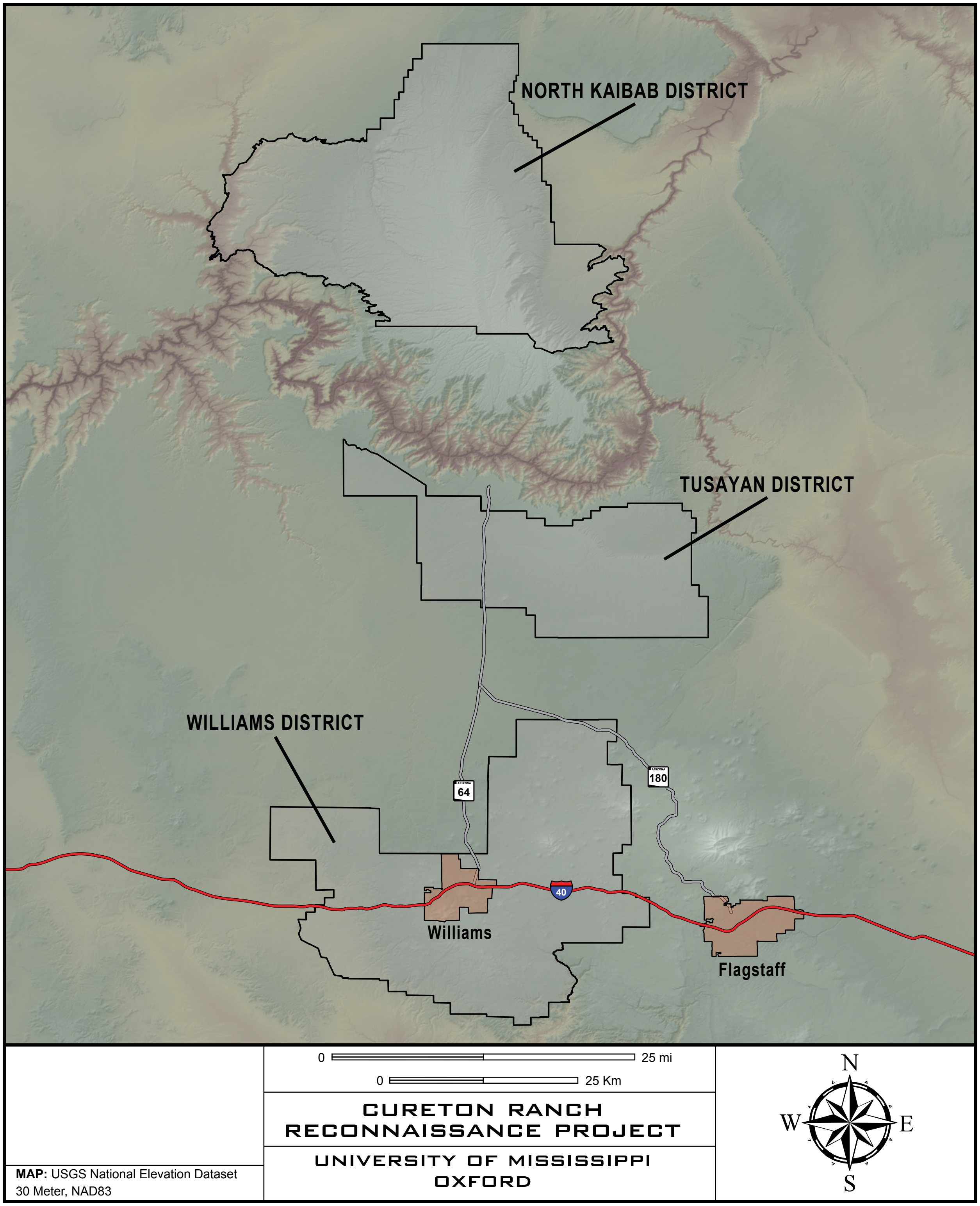

Figure 3.4. Administrative boundaries of the Kaibab National Forest.

The NHPA's focus on identifying, cataloging, and protecting cultural resources on federally administered lands created the impetus for large scale surveys within the National Forest System. Beginning in the mid 1970s, the KNF initiated an effort to meet the requirements of the NHPA, by hiring Thomas Cartledge as its first forest archaeologist. Cartledge spearheaded the first efforts at conducting intensive block surveys of KNF land meant to identify and map cultural resources. The results of those surveys were organized into a digital archaeological database known as the Cultural Resource Automated Information System (CRAIS). This system, in operation from 1977 to 2004, provided a high quality archaeological database of site attribute data that included categories such as cultural affiliation, artifact types and counts, architectural information, and the like. CRAIS has since been replaced by a more powerful database called INFRA, which is an infrastructure corporate database that integrates the entire forest service system.

In the mid-1990s the KNF began linking its archaeological data from CRAIS and later INFRA to their newly created Geographic Information System (GIS). This effort combined accurate and consistent geographic data from archaeological sites such as location and size with data inventoried in CRAIS and INFRA. This powerful combination opened up GIS based regional analysis to archaeologists working on the Coconino Plateau. Currently the KNF has GIS and INFRA data on more than 8,000 sites between its North and South Zones (The North Zone is located north of the Grand Canyon and is represented by the North Kaibab District and the South Zone is located South of the Grand Canyon and is represented by the Williams and Tusayan Districts). This thesis relies on archaeological data resulting from surveys conducted on the South Zone of the KNF resulting in approximately 1,411 km^2 (545 mi^2) of survey coverage or approximately twenty-two percent of South Zone lands (Figure 3.5). These surveys have located approximately 6,850 archaeological sites within the South Zone, of which about 2,800 are identified as Cohonina (Figure 3.5).

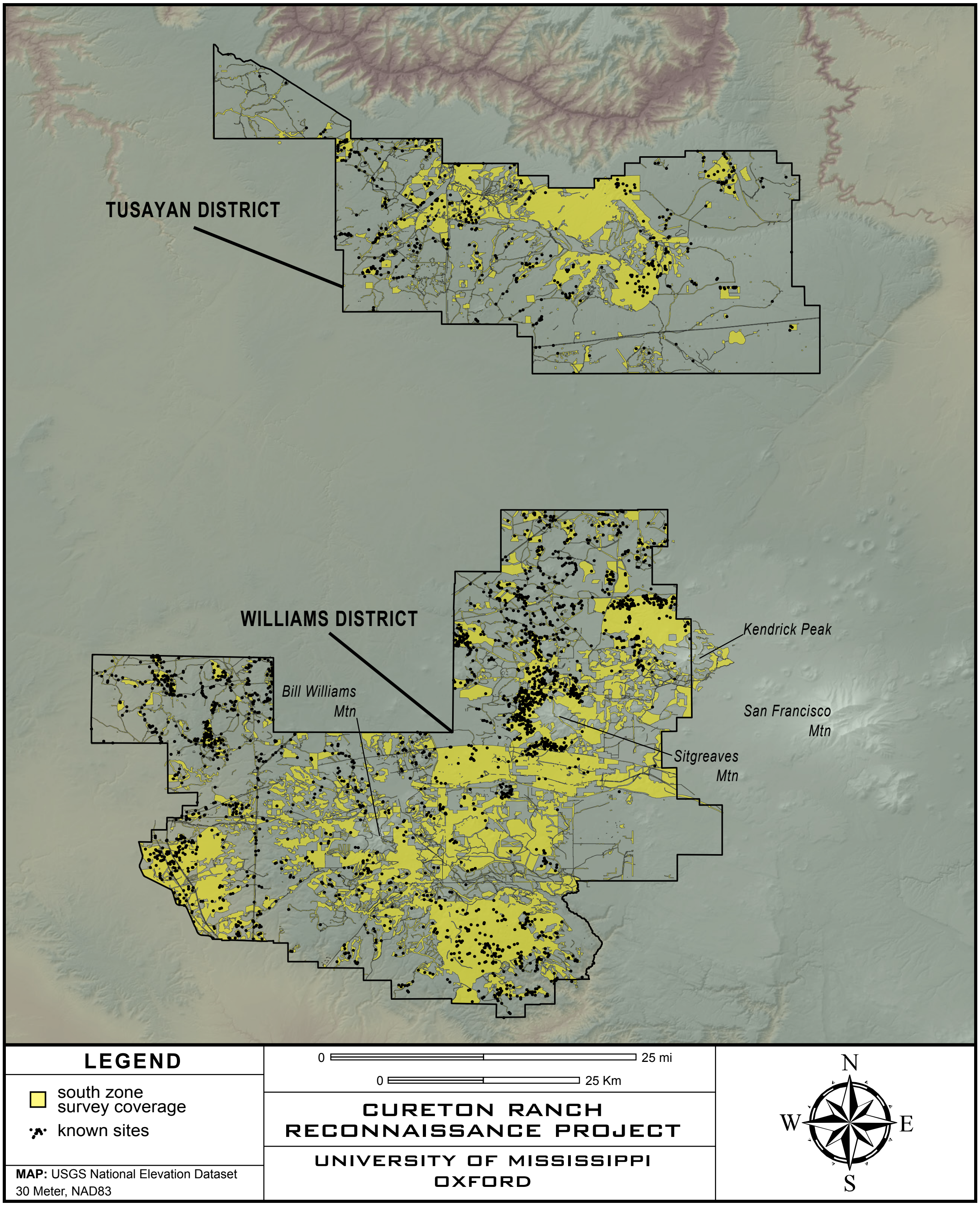

Figure 3.5. Survey and known Cohonina sites on of the Kaibab National Forest. (South Zone: Williams and Tusayan Districts)

Processualism

The early 1970s was also the period when processualism made inroads to Cohonina archaeology via archaeologists working in CRM. Cartledge, acting as the first Forest Archaeologist on the KNF used the theoretical toolkit of the "New Archaeology" to drive a major revisionist effort within Cohonina research. In the early 1990s NAU joined this effort when graduate students began consuming and augmenting data produced by KNF archaeological projects in order to address a variety of topics from settlement systems to social integration. In the mid-1990s, the MNA reasserted its involvement in Cohonina archaeology through research led by David Wilcox. A revisionist agenda informed by processual theory and the methods of broad scale settlement systems survey are the unifying themes in this latest period of Cohonina research although most of its contributors have struggled mightily with basic culture-historical problems.

Cartledge began his tenure at the KNF as its first Forest Archaeologist in 1976. His initial duties revolved around conducting "compliance" work as part of forest projects such as timber sales (Lane 2003:61-62). Most of this work consisted of identifying archaeological sites through pedestrian survey and protecting them from disturbance. However, as archaeological survey data accumulated Cartledge saw a need to reassess the Cohonina concept and its relationship to Southwestern archaeology. Out this effort he produced an article (Cartledge 1979) and manuscript (Cartledge 1986) which arguably are the most important works in Cohonina archaeology since *Sinagua*. These works embody the most comprehensive synthesis of Cohonina archaeology to date and the first programmatic statement in Cohonina archaeology since McGregor led the 1949 expedition to Red Lake and Red Butte. They are also landmark works because they are the first explicit application of processual theory in Cohonina archaeology and that they significantly influenced the direction of future Cohonina research emanating from the KNF, NAU, and the MNA.

Cartledge's Critique of Cohonina Archaeology

Cartledge made his first attempt to reassess the Cohonina concept in an analysis of recently completed survey around Sitgreaves Mountain from a behavioral/adaptation perspective (Cartledge 1979). Cartledge's Sitgreaves Mountain survey was the first large scale and systematic pedestrian survey conducted in the Cohonina region. This focus on systematic survey and de-emphasis of excavation diverged significantly from previous studies that sought out "representative" sites for excavation using casual survey or locational data collected from local informants, e.g. Hargrave (1938). That survey identified and collected data for 157 Cohonina sites within a 2,606 hectare (6,440 ac) timber harvest project area. Sites were located by walking parallel transects spaced 30 meters apart or walking ridgelines where steep terrain prevented the use of parallel transects. Survey crews made small surface collections of temporally diagnostic ceramic types (mostly Tusayan White and Gray wares) in order to establish chronological control at the intersite level. Cartledge continued the use of San Francisco Mountain Gray ware as the Cohonina index ware (Cartledge 1979:303). An emphasis was placed on recording indications of site function, derived especially from architectural remains. Cartledge used these survey results as the basis for a revisionist agenda that focused on deconstructing established views of the Cohonina archaeological culture from a processual perspective (Cartledge 1979:297, 300, 303).

Cartledge attacked received wisdom on the Cohonina from four different angles. His first attack had to do with putting down various unwarranted value judgments that had crept into the literature. He pointed out that from Hargrave (1938) onward the Cohonina were portrayed as culturally impoverished and occupying an unimportant backwater of Southwestern prehistory. Cartledge (1979:300) attributed this phenomenon to a dearth of research in the Cohonina region and dismissed these views as analytically worthless. Instead, he admonished researchers in the Cohonina region to treat divergences from general Southwestern trends as "manifestations of a particular adaptive complex" (Cartledge 1979:300).

His second attack was directed at the Southwestern Taxonomic Method and the relationship of the Cohonina concept to one of the principal Southwestern cultural divisions (Cartledge 1979:300). In particular, he questioned the accuracy of associating the Cohonina with the Patayan root which suggested an adaptive history at odds with the ecological conditions the Cohonina faced on the Coconino Plateau. He argued that this association was based on negative evidence pointed out by Colton (1939) and McGregor (1951) which the Sitgreaves Mountain survey contradicted. Cartledge reported on the presence of numerous sites with circular surface depressions which he interpreted as deep pit houses, an architectural class previously excluded from the Cohonina architectural repertoire, Colton's (1939, 1946) ambivalent statements on the matter notwithstanding. Some of these depressions are much larger than the modal diameter of eight meters Cartledge observed, leading him to suggest a public or community function for these extra large pit houses. This is another class of architecture previously denied the Cohonina, McGregor's (1967b) tentative admission notwithstanding. He also documented the existence of features consisting of well ordered surface alignments of masonry rubble. He interpreted these features as masonry structures. Cartledge reported that two of these sites exhibit contiguous masonry room-blocks arranged around plazas and connected to substantial compound walls, negating McGregor's (1967b:306) contention that Cohonina communities were internally planless. Given these discoveries, he suggested that the Cohonina archaeological culture shows stronger affiliations to Anasazi and Sinagua material to the east, rather than that found to the west in the Patayan region (Cartledge 1979:309).

Cartledge strengthened this argument based on the results of his third attack which revolved around a reassessment of the Cohonina architectural tradition formulated by McGregor (1951, 1967a, 1967b). He abandoned McGregor's architectural typology based on excavated features in favor of one developed for surface recorded features. Cartledge recognized four classes of sites exhibiting architectural remains: sites with pit houses alone, pit houses with amorphous stone rubble, pit houses with surface masonry, and sites with surface masonry alone. After assigning one of two phase designations (Coconino [A.D. 700 to 950] or Medicine Valley

[A.D. 950 to 1100]) to sites categorized according to his typology, Cartledge found that change in Cohonina architectural forms around Sitgreaves Mountain followed a general trend found throughout the northern Southwest: an increasing use of above ground masonry construction over time relative to pit structures (Cartledge 1979:307). Cartledge observed that Coconino Phase masonry consisted of small structures associated with pit houses. During the Medicine Valley Phase contiguous room-blocks appear, along with the previously mentioned plaza sites which he assigned a communal function to. Taken together, these observations revealed that the Cohonina were more integrated into general Southwestern processes than previously envisioned.

Cartledge launched his final attack on Schwartz's (1956, 1966) demographic reconstructions for the Cohonina region. Schwartz (1966) modeled 600 years of Cohonina demographic change and pointed out parallels to Anasazi models. Cartledge argued that Schwartz ignored the complex relationship between increasing sedentism triggered by changes in economic production and how that affects settlement systems upon which demographic models are based (Cartledge 1979:313). His analysis of the Sitgreaves data showed that both structure and room counts were higher during the Coconino Phase, possibly indicating an earlier population peak than what Schwartz proposed. However, Cartledge argued that even if population was increasing in the Cohonina region during the Coconino and Medicine Valley phases, the archaeological record reflects that change only indirectly. Instead the changes in the settlement system around Sitgreaves Mountain, Cartledge argued, are likely more a reflection of changing human-environment relationships associated with an increasing reliance on agricultural production and unknown degree of reliance on mobility. This shift in focus from reconstructing historical events to searching for their underlying causes marks an important change in Cohonina research.

Cartledge wanted this kind of processual/adaptive research based on settlement systems data to become the norm in Cohonina archaeology. Indeed, the overwhelming majority of new data is of the settlement systems variety derived from CRM block survey. However, he acknowledged that poor control of time-space relationships, a lack of fine grained data on environmental change, and inability to definitively model Cohonina subsistence had all dogged his pursuit of the overarching goal of his processual research, that is "working out changing patterns of human behavioral adaptation on the Coconino Plateau" (Cartledge 1979:316).

Cartledge's Processual Synthesis of Cohonina Archaeology

In the early 1980s Cartledge continued his effort to examine Cohonina behavioral adaptation as part of a study related to federal land managers' ongoing efforts to meet the requirements of the NHPA. This study was intended to act as a foundational document, known as a "Cultural Resource Overview", upon which historic preservation management policy for the KNF and Bureau of Land Management in Northern Arizona would rest. Unfortunately, funding to complete the study never materialized and the manuscript was relegated to the realm of so called "black literature". However, Cartledge and Teri Cleeland completed a shortened draft of the study covering archaeological research dealing with the beginnings of human occupation on the Coconino Plateau, through the Protohistoric Period (Cartledge 1986) and on to the Historic Period (Cleeland 1986). Despite the document's unfinished state and relative obscurity, Cartledge's section stands out as one of the most important documents in Cohonina archaeology for several reasons. Whereas previous synthetic studies of Northern Arizona prehistory assigned secondary importance to Cohonina topics at best, Cartledge's overview is primarily concerned with the Cohonina. Further, Cartledge made the first explicit statement of a processual theoretical perspective in Cohonina archaeology. Lastly, he used that perspective to synthesize the accumulated corpus of knowledge out of which he expounds a programmatic statement that has influenced the direction of Cohonina research ever since.

After summarizing the overwhelming majority of Cohonina related research, Cartledge made his commitment to processual archaeology known in a statement of theoretical orientation. He argued this exercise was a necessary part of conducting sound research because the theoretical framework he employed would constrain the methods of data collection and analysis, and his final interpretations (Cartledge 1986:43). He cites Lewis Binford's 1968 essay "Archaeological Perspectives" as the basis for this argument and his resulting conclusion that only processual theory allows the fullest use of archaeological data, as opposed to culture-historical and functionalist theory. Binford (1968:27) argued that the ultimate goal of archaeology is to formulate general laws of cultural dynamics. He went on to state that goal is only achievable within a hypothetico-deductive framework that analyzed archaeological phenomena in a hierarchal exclusive arrangement beginning with reconstructions of culture history, followed by reconstructions of lifeways, and finally the elucidation of culture process. Thus focusing only on culture-historical or functionalist problems precludes study of processual problems and so on. Cartledge (1986:47) suggested that beginning from a processual view, that is, actively seeking to explain change in human behavior through time, not only allows, but requires inquiry into culture-historical and functionalist problems.

The views expressed in Binford's essay were part of a series of papers that marked the formal debut of New Archaeology (Trigger 2006:393) making it no surprise that Cartledge would build his processualist argument on such a foundation. Binford and his supporters (Binford and Binford 1968) presented New Archaeology as the advent of truly scientific work in the discipline and described processual studies as the pinnacle of archaeological inquiry, a view Cartledge (1986:47-48) supported. Moving forward from this processual positioning, Cartledge outlined a set of assumptions and goals that formed his interpretive framework. He assumed that past human behavior is knowable from the archaeological record and that temporal change in behavior is not a result of historical contingency. In other words, he assumed that uniform principles exist in the process of socio-cultural change in the past and present, and that these principles are accessible to the archaeologist. In order to examine processual change, Cartledge like other processualists, viewed culture as a system of functionally integrated structural elements to which human behavior could be related to. He argued further that the archaeological record reflects aspects of these structural-functional elements, what Binford called "subsystems". Thus the task of the archaeologist consists of identifying relevant subsystems in the archaeological record, establishing how they articulate, and finally tracking and explaining change in and between those subsystems over time.

Cartledge suggested that certain subsystems are better preserved in the archaeological record than others, and that some of those are more analytically useful. He isolated two “factors” that he felt archaeological data were most amenable to: economics and social organization (Cartledge 1986:48-49). He divided his economic factor into technology, settlement patterns, subsistence practices, and exchange networks subsystems while his social organization factor consisted of demographic and social organization subsystems. Finally, he included an environmental subsystem. His “factors” and associated subsystems accord very closely with those identified by Binford (1965): technoeconomic, social, and ideological. The differences apparent in Cartledge’s model of culture versus Binford’s might reflect two important aspects of processualism. First, identification of an environmental subsystem might reflect the processual approach’s focus on ecology as a prime mover determining cultural configurations. Second, processualists show a tendency to shy away from cognitive or symbolic problems and this might be reflected in Cartledge favoring the environmental over the ideological. His division of economic and social factors into more specific subsystems might reflect an effort to fit Binford’s model of culture to the data he had at hand. Differences between Cartledge and the patriarch of New Archaeology aside, Cartledge used his processual stance to drive a new synthesis of Cohonina archaeology.

Cartledge divided his synthetic chapter into two sections addressing the preceramic and ceramic periods on the Coconino Plateau. The preceramic section addresses the Paleoindian period and the Early, Middle and Late Archaic periods. Topics covered in the preceramic section are not discussed here because they are outside the focus of this thesis. Cartledge divided the Ceramic period into sections addressing chronology, the Cohonina culture, and a final section dealing with the Kayenta, Sinagua, and Cerbat cultures. He focused the majority of his effort on the Cohonina concept and split his discussion into five cultural subsystems including technology, settlement patterns, social organization, exchange, demography, but excluded an environmental subsystem. In the course of his Cohonina synthesis Cartledge isolated a set of research problems whose explication he identified as critical to furthering Cohonina research. He highlighted these problems within discussions of each the various cultural subsystems he identified. I will only critically assess his subsections on technology, settlement patterns, social organization and exchange because they bear most directly upon the current study.

The second section of Cartledge's Cohonina synthesis addresses the broad category of technology and falls within Binford's "technoeconomic" subsystem. He split this discussion roughly into two subsections. The first deals mainly with "in-hand" technology including ceramics, chipped stone, ground stone implements, ceramic vessels, and other objects such as bone. With the exception of ceramic technology, these topics are not reviewed here. The second subsection is pertinent to this thesis and addresses Cohonina architectural, agricultural, and "small feature" technologies. Cartledge focused on assessing the various typologies in use for these technoeconomic categories and summarizing the methods and materials the Cohonina employed in the manipulation of their environment.

Ceramic Technology

Cartledge provides a reassessment of Cohonina ceramic technology and the typologies employed by archaeologists to study that material. His inventory of ceramic objects produced by the Cohonina includes vessels (far and away the most numerous), cylindrical pipes, and repurposed sherds formed into scrapers, disks, and perforated disks. Cartledge lists non-local ceramic types encountered on the Kaibab National Forest as including Tusayan White Ware, Tusayan Gray Ware, San Juan Red Ware, Tsegi Orange Ware (Kayenta wares), Alameda Brown Ware (Sinagua), Prescott Gray Ware (Prescott), and Tizon Brown Ware (Cerbat). This reassessment is not markedly different from previous analyses and he upheld the San Francisco Mountain Gray Ware typology produced by Colton (1958) as the most accurate, with some minor modifications. First, he pointed out that the reduction firing atmosphere used in the production of San Francisco Mountain Gray Ware was not as consistent as Colton supposed. He cites the presence of brown

San Francisco Mountain Gray ware sherds from contexts around Sitgreaves Mountain to argue Cohonina potters also used an oxidizing or loosely controlled reducing atmosphere on occasion. This observation parallels McGregor's (1967b) earlier observation that surface color clines ranging from grey to brown exist in the regional distribution of San Francisco Mountain Gray Ware. Cartledge also argued for the addition of two types: Deadmans smudged and Deadmans corrugated. He describes the former as San Francisco Mountain Gray Ware bowls with smudged interiors and the latter as a parallel type to Tusayan Corrugated (a.k.a Indented Corrugated), of the Tusayan Gray Ware series. He felt that neither of these types was particularly common or important amongst the Cohonina.

Several studies emanating from NAU (Garcia 2004; Sorrell 2005), the University of New Mexico (Mills et al. 1993), and other academic institutions (Carter and Sullivan 2007:141-143 Carter et al. 2011) provide a near comprehensive reassessment of the San Francisco Mountain Gray Ware series. Mills and colleagues' (1993:62-63) reexamination of Colton's (1958) San Francisco Mountain Gray Ware typology resulted in the most concise typology to date. An important contribution of this effort has to do with correcting a long standing bad habit amongst Cohonina archaeologists concerning the identification of Floyd versus Deadmans Gray sherds. From McGregor (1967a) on, Floyd Gray was, and still is, considered a parallel type to Kana-a Gray of the Tusayan Gray Ware series, with both types defined as vessels exhibiting un-obliterated coils on the rim and neck portion of the jar. Mills et al. (1993), following Colton (1958), define Deadmans Gray as undecorated San Francisco Mountain Gray Ware jars lacking un-obliterated neck coils. Thus, both types require the neck/rim portion of the vessel for identification, but a situation developed in Cohonina archaeology wherein most body sherds are identified as Deadmans Gray even though this violates the definition of the type as defined by Colton (1958). Mills and colleagues alleviated this problem by adding a "Floyd/Deadmans" taxon to their San Francisco Mountain Gray Ware typology. This has important ramifications for the use of these types as chronological markers.

Downnum (1988, 2003) and Christenson (1994) used revised raw tree-ring data (Robinson et al. 1975) to produce the most accurate production dates for many individual types availible (reported in Garcia 2004; Sorrell 2005; Schubert 2008). These findings manifest in the San Francisco Mountain Gray Ware series as alterations to production runs for types that parallel those in the Tusayan White Ware series. Floyd Gray and Floyd Black-on-grey are stylistically parallel types to Kana-a Gray and Kana-a Black-on-white and their temporal co-occurrence is well attested (McGregor 1951, 1967a; Sorrell 2005; Schubert 2008). Thus production run dates for those types should parallel those for the Kayenta types in the absence of contradictory evidence. Production runs for the San Francisco Mountain Gray Ware types Deadmans Gray and Deadmans Black-on-grey are ambiguous. A Tusayan Gray Ware type parallel to Deadmans Gray is not readily forth-coming and Sorrell (2005) found it not useful as a temporal marker. Part of this situation might be traceable to the Floyd/Deadmans identification problem described above, but the principal factor here is that Deadmans grey had a long production run. That said the production start-up date for the type, traditionally set at A.D. 700, is likely too early. Sorrell (2005) among others (Lyndon 2005; Schubert 2008) argue the earliest wide spread distribution of San Francisco Mountain Gray Ware dates to around A.D. 800 and was likely preceded by a proto-San Francisco Mountain Brown Ware. An A.D. 1200 production end date for Deadmans Gray, however, is still valid (Sorrell 2005; Schubert 2008).

Deadmans Black-on-grey is traditionally considered a parallel type to Black Mesa Black-on-white. While the former type definitely exhibits the Black Mesa style in many instances, it also exhibits motifs more in-line with Kana-a or Wepo Black-on-white in some examples (Garcia 2004), and motifs with no parallel in the Tusayan White Ware design series in still others. Thus it is no surprise that Sorrell (2005) and Schubert (2008) found that Deadmans Black-on-grey is not useful as a temporal marker. Given these findings, Deadmans Black-on-grey likely had a long production run that encompassed a number of styles, of local and non-local derivation, as in the case of Shato Black-on-white of the Tusayan White Ware series (Hays-Gilpin and van Hartesveldt 1998). All San Francisco Mountain Gray Ware types exhibit the presence of hematite wash in varying frequencies (Mills et al. 1993). Sorrell (2005:63-64) found that the frequency of fugitive red wash did not vary consistently over time, while it does exhibit significant sub-regional spatial variation on the Coconino Plateau.

Finally, several compositional studies (petrographic in particular) have been undertaken in order to examine aspects of San Francisco Mountain Gray Ware's production and exchange. These analyses (Mills et al. 1993; Landis 1993; Roberts 2001; Carter and Sullivan 2007; Carter et al. 2011) and there critiques (Garcia 2004; Sorrell 2005) suggest that in the case of San Francisco Mountain Gray Ware, its structural characteristics and distribution on the landscape appear to represent a folk that shared a common tradition of pottery manufacture executed within individual communities. This means that while some variation existed in the production of San Francisco Mountain Gray Ware, manifested as variable firing regimes, presence/absence of scraping striations and fugitive red wash, and variation in vessel fabric constituents, the producers of San Francisco Mountain Gray Ware held in common a symbolic system of ceramic manufacture that maintained a high degree of consistency in that ware across space and through time, which in turn must reflect some aspects of a strongly held shared group identity.

The preceding discussion indicates Colton's formulation of the index ware and its underlying assumptions have been thoroughly critiqued with regards to whether or not they represent the actual distribution of past ethnic groups, their concepts of ethnic boundaries, or their shared notions of just how ceramic vessels should be constructed. However, the concept survived these criticisms with some modifications and refinements, especially concerning ethnicity (Garcia 2004; Carter and Sullivan 2007:141-143, but see Elson 2011). In other words Colton's concept of the index-ware and the practice of identifying sites as Cohonina based on the presence of San Francisco Mountain Gray ware are not going anywhere until something better comes along.

Architecture

Cartledge critically reviewed McGregor's Cohonina architectural typology, upholding some taxa, rejecting others, and adding new architectural classes based on Kaibab National Forest (KNF) surveys. Cartledge rejected McGregor's contention that the Cohonina did not build pit houses citing McGregor's (1951, 1967a) own data as well as Colton (1939) in support of that view. The major interpretive change Cartledge made here hinged on exposing McGregor's bizarre typological maneuvering in calling the Mt. Floyd pit houses "deep pit structures" or "rooms with a subsurface floor" (McGregor 1967a:76) and Colton's (1939:27) odd conclusion that Cohonina folk were reoccupying abandoned Sinagua pit houses in the manner of squatters (Cartledge 1986:96). Cartledge's (1979) survey around Sitgreaves Mountain revealed 163 circular depressions, usually rock lined, which he interpreted as pit houses of varying size. Wilcox (1995) later confirmed this inference by excavating a set those features at Sitgreaves Mountain, revealing robust construction and central hearths.

Cartledge upheld McGregor's "ramada" architectural class as it is well documented through excavation and suggested that these structures were quite common. In his review of McGregor's "alcove house" and "patio house" classes he suggests that these classes should be collapsed into a single "shallow pit house" class because they do not differ substantially from each other or from currently accepted definitions of shallow pit houses (Bair and Stoker 1993). He also upheld McGregor's "unit structure" class and argued these masonry/jacal structures are recognizable on the surface as contiguous north-south arrangements of rectangular rock outlines; one or a few courses high. Again Wilcox's (1995) excavations around Sitgreaves Mountain confirmed this link.

Even in its modified form, McGregor's architectural typology is only marginally useful for pedestrian survey data. Cartledge (1979) realized that point and developed a surface feature typology that better fit the architectural phenomena Cohonina archaeologists encounter during survey. Samples (1992) conducted a settlement systems analysis of the Sitgreaves survey data collected and reported by Cartledge (1979). He implemented a modified version of Cartledge's surface feature typology to examine the Sitgreaves Mountain settlement system in hopes of identifying patterning that reflects aspects of Cohonina social organization and to form a base from which comparative studies of other recognized Cohonina settlement systems could be undertaken. His typology included ten classes based on surface characteristics that covered artifact scatters, architectural remains, rock art, and agricultural features. This modified typology provides a current synthesis (with some exceptions, see below) of known Cohonina architectural variability and incorporates Cartledge's interpretive linkages between surface features and McGregor's excavated architecture types.

Cartledge identified two types of integrative facilities between his 1979 article and 1986 synthesis. The first of these is the "extra large pit house" which are defined by deep surface depressions greater than 10m in diameter (see above). The second are forts (see below). Cartledge (1979) reported on the existence of very large circular depressions ringed by stone rubble within the Sitgreaves Mountain settlement system. Beginning in 1989, the joint NAU, MNA, Oberlin Archaeological Field School under the direction of David Wilcox opened up excavations at a number of sites within that settlement system. One of those sites (03070200145) had an extra large rock-ringed depression measuring 13 meters in diameter. This feature was partially excavated, revealing an inner pit house measuring nine meters in diameter, 75 centimeters deep, and having a large central hearth. The investigators argue the exterior rock ring formed a foundation upon which a timber roof was constructed and then covered with earth, forming a bench area encircling the main occupational space below.

Samples (1992) seconded Cartledge's interpretation of these features when he argued that extra large pit houses were integrative features operating on the suprahousehold level within the Sitgreaves settlement system. He based this argument on distinct clustering of contemporaneous elements consisting of smaller pit structures and surface masonry features around extra large pit structures, similar well reported phenomena in the Sinagua region; and ethnographic data demonstrating that semi-sedentary, non-ranked agricultural societies utilize structurally separate communal buildings as a locus for the enactment of integrative behavior (Samples 1992:134-136). However, while the integrative function of Cohonina extra-large pit houses is well attested, their period of operation is not. Samples suggested that these communal features were an early form of public architecture (A.D. 850 to 1000) within the Sitgreaves Mountain settlement system, but their presence at multi-component sites and lack of precise dating makes this supposition rather tentative.

Two other Cohonina integrative facilities have been identified since Cartledge produced his Cohonina synthesis. The first of these is the so-called "Hohokam style ballcourt". These features are well known within the Sinagua region of the plateau, but the existence of ballcourts within Cohonina contexts was actually known as early as 1935. However, the discovery of Ballcourt No. 2 on Deadman Mesa (NA804 [Colton 1946:76-77]) predates the formulation of the Cohonina concept, making it somewhat understandable the MNA school excluded the Cohonina as participants in the ball court phenomenon (cf. interpretative agendas above). It would be another six decades before Northern Arizona archaeologists acknowledged the connection between ballcourts and the Cohonina when five more were documented within the Cohonina "core" area (Wilcox et al. 1996), bringing the known total of Cohonina ballcourts to eight.

The functional interpretation that these features were a social space where some version of the Mesoamerican ballgame was played is well established (Wilcox and Sternberg 1983; Abbott et al. 2007). And the existence of a dense network of these ballcourts within the Hohokam regional system south of the Cohonina between A.D. 800 and 1200 (cf. Abbott el at. 2007:471) implies a public symbolic system held in common over a wide area, which articulated with the Cohonina and Sinagua regions; providing the basis for socioeconomic interaction and integration over a far-flung area. Abbott and colleagues (2007:463) argue gatherings and festivities at ballcourts supported markets wherein commodities were moved through mechanisms of barter and ritual exchange. There is no reason at this point to suspect that Cohonina ballcourts functioned in a different manner (Wilcox et al. 1996:442).

The second recent addition to the public class of Cohonina architecture is the "plaza" site. As with ballcourts, sites with plazas such as Three Courts Pueblo (NA618) and Juniper Terrace (NA1814), now attributed to the Cohonina, were known from a very early period east of San Francisco Mountain (Colton 1946), but were acknowledged as having an integrative function only much later (Wilcox 1995; Stone and Downum 1999). Hargrave recorded a masonry site on the west slope of Sitgreaves Mountain (NA3594 [MNA Site Cards]), which Cartledge relocated in the late 1970s (Site 0307020140) and designated it as a plaza site along with another site nearby (0307020152, aka Walavudu) (Cartledge 1979:305). These sites, along with Three Courts Pueblo and Juniper Terrace, consist of well ordered room blocks surrounding one or more plazas, and are partially or completely surrounded by a massive enclosing wall. While Cartledge described these sites (0200140 and 0200152) in his 1979 article, he did not consider their integrative potential in that article nor his 1986 synthesis. Samples (1992:137) was the first to suggest Cohonina plaza sites were integrative facilities. Specifically he suggested 0200140 and 0200152 were the loci of activities that integrated Cohonina society on the suprahousehold level, that is beyond that of the extra-large pithouses; because they are the largest sites on Sitgreaves Mountain and are centrally located within the densest area of occupation.

Stone and Downum (1999) later suggested the massive multi-plaza site known as The Citadel was part of a system of land tenure based on extensive rather than intensive agricultural production in the post-Sunset Crater eruption years. In that model of late Cohonina political economy in the Wupatki area, highly variable post eruption ecological circumstances precluded Boserupian agricultural intensification in the face of increasing population pressure. Instead, extensive field systems emerged that took advantage of diverse microenvironments that "respond differentially to inter-annual variation in precipitation", creating a sort of micro-environmental risk buffering strategy (Stone and Downum 1999:114). This agricultural response to demographic and ecological factors exerted strong pressures on local populations to develop shared concepts of property rights and land tenure, which in turn required the development of public symbolic systems that visually stake claim to use rights on the landscape. Stone and Downum argue these symbolic systems manifested as systems of field houses and rock bordered fields. However, they also argue the mesa top pueblo known as the "The Citadel" functioned not only as a place of habitation, but also as a hyper-visible symbol of group authority. The Citadel, so argue Stone and Downum (1999:121), signaled ownership of the local landscape, the strength of an aggregated population, and the threat of retaliation in the event of intrusion onto or usurpation of agriculturally productive land.

Bone (2002) compared several attributes of Cohonina public architecture types (excluding extra-large pit houses) in an attempt to examine the nature of Cohonina social integration between two distinct sub-regions of the Coconino Plateau and within the Kaibab National Forest: the Cataract Creek (northwest) and Verde River (southwest) Drainage Basins. He compared six primary attributes among forts, plazas, and ballcourts between the two subregions including: enclosed public space, frequency of habitation sites within 3km of public architecture, total number of habitable rooms, room contiguity, and the degree of variety within ceramic assemblages (Bone 2002:76-80). Bone used a set of non-parametric statistical tests to compare public architecture between the northwestern and southwestern subregions and found no significant difference in any public architecture attribute between subregions and site types, or within site types (Bone 2002:91). However he did find that certain classes of public architecture are geographically more limited than others. Bone found that ballcourts are clustered along southwestern subregion along the Mogollon Rim, while plazas are restricted to the northwestern subregion around Sitgreaves Mountain. Forts are markedly different in that they are ubiquitous across the Coconino Plateau.

Bone interpreted this lack of variability between the Cataract Creek and Verde River subregions as supporting the conception that the inhabitants of the two subregions were essentially the same population organized at the "tribal" level of social complexity. Bone's argument that he could not confidently reject the long standing conception of the Cohonina as a culturally unified population provides cautious support for the Cohonina concept without courting the contentious issue of Cohonina ethnicity. The lack of difference between the subregions in terms of public architecture size (enclosed space) also suggests that the size of the population coming together at these locations was about the same throughout the plateau, meaning a "regional center" economic, religious, or otherwise is not forthcoming.

Bone's study can be criticized on three fronts. First, there clearly are differences between the two Coconino Plateau subregions examined in terms of integrative facility morphology, suggesting differences in specific function and by extension integrative behavior carried out. Ballcourts are spatially discrete from plazas and extra-large pithouses. The former occur primarily along the Mogollon Rim (excepting Ballcourt No. 2, Second Sink and Wupatki Road ballcourts near Deadman Mesa), while the latter occur throughout the central and northeastern portion of the Coconino Plateau. Forts are the only public architecture type that occurs throughout the Cohonina region. Bone (2002:97, 100) acknowledged these morphological and geographic differences, but declined to work out the specific function/meaning of forts, plazas, or ballcourts, arguing only that the markedly large size of these sites identified them as generally socially integrative. His awareness of this shortcoming led him to single out the fort class of architecture as needing the most attention in terms of future research. Second, Bone did not include data from the eastern Coconino Plateau in the area of Deadman Wash where some of the most impressive Cohonina sites are located. Had he done so, plaza sites such as Juniper Terrace and The Citadel may have emerged as something altogether different from their western counterparts.

Lastly, Bone's approach to investigating Cohonina public architecture was couched in terms of a "tribal" model of social organization ultimately informed by Sahlins (1968) via Braun and Plog (1982). This model is in turn positioned within a schema seeking to understand emerging hierarchical social complexity driven by environmental risk, along an evolutionary trajectory populated by stages such as "bands", "tribes", "chiefdoms", and "states". The social evolution of Sahlins and Service and its attendant typological issues has its problems (Wolf 1982; Pauketat 2007; Carneiro 2010) and is at odds with much of what is known of prehistoric Southwestern social organization (Cordell 1999:91), ostensibly the major goal of Bone's study. It now appears that alternative models focused on production and exchange (especially those examining horizontal complexity) have the most promise to date. Despite these shortcomings, Bone's study revealed a point of considerable importance: the way in which the Cohonina went about organizing themselves and the numbers of actual people involved at any given integrative performance were roughly similar across the western Coconino Plateau.

Settlement Patterns

The next subsystem pertinent to this thesis that Cartledge addressed was settlement patterns. Prior to the initiation of the KNF's campaign of broad scale pedestrian survey, very little could be said about Cohonina settlement patterns. However, resource management goals of the KNF drove archaeological research typified by Cartledge's 1979 Cohonina settlement systems based article (see above), resulting in an explosion of raw data. By the early 1980s Cartledge had enough survey data on hand to make some broad generalizations about Cohonina settlement. First, he found that the location of Cohonina sites very strongly correlate with Great Basin Conifer woodland (a.k.a piñon-juniper woodland), while the Ponderosa forests have comparatively fewer sites, and the central grasslands almost completely lack sites. When he examined the piñon-juniper woodlands more closely, Cartledge found areas of high Cohonina site density separated by zones of considerably lower density (Cartledge 1986:101). He also found that high density site clusters are located on the slopes of the major mountains of the San Francisco Volcanic Field, i.e. Bill Williams, Kendrick, Sitgreaves, and Cedar Mountains. Along the northern edge of the plateau and away from the volcanic field Cartledge found high site densities along prominent drainages.

Despite these accomplishments, Cartledge was unable to elaborate on the specifics of Cohonina settlement. He cited a lack of temporal control and inability to assess duration of site use as impediments to that effort. Cartledge also pointed to a dearth of studies aimed at understanding the function of Cohonina sites as particularly obstructive to settlement systems research.

He argued that without a clear understanding of site type function, the goal of understanding the underlying structure of Cohonina settlement would remain out of reach.

Samples (1992) used his functional interpretation of Cohonina architecture types as a launching point to describe the basic structure of Cohonina settlement within one high density site cluster known as the Sitgreaves Community. After separating sites into an "early" and "late" chronology (see above), he examined the relationship between pit houses and masonry structures. Samples assumed pit houses were habitations and followed precedent (Hargrave 1938; McGregor 1951) in inferring that most small masonry structures within the Sitgreaves Community were storage facilities. He placed other sites with architecture in either the shallow pit house, unit structure, or plaza class, based on surface morphology. At the simplest level, he found that Sitgreaves community sites consist of either a single pit house or masonry structure (Samples 1992:128). The next level of complexity consists of sites exhibiting a pit house and masonry structure. Samples found this pit house-masonry structure arrangement also forms a basic unit within more complex sites exhibiting many structures. I noted earlier that Cartledge and Samples identified extra large pit houses as integrative facilities and it is around these structures that multiples of the previously mentioned architectural unit cluster, forming a higher level of complexity within the Sitgreaves Community. These clusters are repeated across the landscape, forming a horizontally complex pattern. At the apex of the Sitgreaves settlement pattern are two plaza sites (see above), around which all other sites cluster. Whether or not this apparent 3-tier settlement system is the norm in the Cohonina region is entirely unknown.

Cartledge next discussed Cohonina subsistence, a closely linked subsystem to settlement patterns. Previous researchers such as Hargrave (1938), McGregor (1951, 1967a, 1967b, and Colton (1946, 1960) all had limited success understanding the Cohonina economic base. Cartledge understood that characterizing settlement patterns is a necessary first step to understanding the conditioning influences local environments exert on humans as they go about provisioning themselves; that is engage in the basic economic business of subsistence. Building on that basic understanding, he saw subsistence as a key to unlocking the logical structure behind

Cohonina settlement. He pointed to the seeds produced by several closely related pine tree species collectively known as piñon pines as potentially the single most important food resource on the Coconino Plateau and argued that the robust clustering of sites in the piñon-juniper woodland on the plateau reflected that importance (Cartledge 1986:103). However, his supporting evidence was anecdotal, consisting only of a passing reference to the nutritional value of piñon nuts and their importance in the modern Navajo economy. Cartledge went on to reiterate the thin evidence for other subsistence activities such as maize agriculture and hunting, forcing him to fall back on the abundant, but indirect technological evidence of these pursuits in the form of ground and chipped stone tools. However, he did report that Cohonina sites consisting of artifact scatters and lacking features exhibited high frequencies of these tools, suggesting a functional emphasis on food gathering and processing. In the end Cartledge was unable to push the discussion of Cohonina subsistence much beyond what McGregor had documented in the 1950s and 60s.

Several recent studies bear directly on the problem of Cohonina subsistence/settlement. When the KNF compiled its archaeological site files into a GIS in the early 1990s archaeologists began taking advantage of that major advancement in Cohonina archaeology almost immediately. The KNF archaeological database, compiled as a GIS, provides an impressive and ever-expanding data set uniquely suited to addressing a variety of problems directly relating to Cohonina settlement systems analysis. Before the advent of GIS in Cohonina archaeology, no single researcher could hope to manage the several thousand site regional database stored in KNF file cabinets. A GIS allows manipulation of huge spatial datasets, making it ideally suited to approach Cohonina settlement systems (see Chapter 4). Schubert (2008) used the KNF archaeological database to test broad scale correlations between a host of environmental and site variables. He aimed to reveal patterning in Cohonina site locations in relation to the physical environment with an overarching goal of testing ideas related to Cohonina settlement/subsistence (Schubert 2008:80).

On a broad scale, Schubert (2008:92) confirmed Cartledge's observation that most Cohonina sites are located in Great Basin Conifer woodland: 55% in a biotic community covering just 34% of the study area (KNF administered lands). The significance of piñon-juniper woodland in Cohonina subsistence became more apparent when Schubert (2008:96, 101) examined the location of Cohonina sites exhibiting ground stone artifacts, finding that over 64% of those sites fall within piñon-juniper woodland. This association suggests much of the Cohonina subsistence economy was focused on processing food sources within that zone.

Cartledge (1986:101) had advanced the notion that piñon nuts harvested from Great Basin Conifer woodland may have been an important staple in the Cohonina diet and since then a mounting body of evidence supporting that claim has accumulated. In a closely argued article focusing specifically on the productivity of piñon-juniper woodland, Sullivan (1992) dispels the entrenched cant that piñon-juniper woodland provides a marginal resource base. On the contrary, piñon-juniper woodland has enormous productive potential in terms of wild game and herbivorous resources (Sullivan 1992:199), especially the predictable and highly nutritious staple crop that is piñon nuts (Lanner 1981; Sullivan 1992:200, Janetski 1999:249-250). Sullivan's (1986) work in the Upper Basin of the Coconino Plateau revealed the Western Anasazi there relied considerably on piñon nuts and other products of the piñon-juniper woodland. Those arguments are easily extended to the Cohonina who exhibit similar settlement patterns and were exploiting the same biotic community just to the south.

Schubert also attempted to carry forward the discussion of Cohonina horticulture by testing the feasibility of maize production in the Cohonina core. He used a GIS to compare Cohonina settlement patterns to several contemporary environmental variables relevant to maize production including temperature, precipitation, seasonality in precipitation, and distance to water. Seasonality in precipitation was Schubert's most productive analysis here, in that it revealed the Cohonina placed their logistical sites (sites lacking habitation features) in areas on the plateau that received the most precipitation during the summer (Schubert 2008:118). This pattern is especially strong for sites exhibiting groundstone, but comparatively weak for sites with evidence of habitation. That the Cohonina produced and consumed maize is well demonstrated by the presence of that cultigen at Cohonina sites (Hargrave 1932, 1938; Colton 1946; McGregor

1967b, Wilcox 1995) and a steadily increasing inventory of agricultural features (McGregor 1967a; Samples 1992:61; Schubert 2008:71). Schubert's analyses suggest summer growing season precipitation was an important factor influencing Cohonina settlement, lending further support to the idea that the Cohonina were at least part-time horticulturists. Unfortunately, the relative importance of maize and its associated cultigens (squash, beans, and cotton) in the subsistence economy of the Cohonina remains undetermined.

Another problem Schubert attempted to tackle in the realm of settlement systems analysis is the importance of mobility in Cohonina subsistence. I noted above that McGregor was the first to suggest the Cohonina followed a seasonal round. Later, Samples (1992) attempted to examine that model of Cohonina socio-economic organization within a temporal framework (Samples 1992:9). However, the results of that spatial analysis were ambiguous (Samples 1992:123) in that he did not find any strong correlation between the Sitgreaves settlement pattern, agricultural improvements, and environmental factors conducive to either horticulture or gathering. This ambiguity led Samples to question the possibility that the Cohonina were sedentary folk and went on to argue the architectural tradition of the Cohonina exhibits evidence of seasonal mobility. He based this argument on McGregor's (1951) earlier suggestion that the ramada and shallow pit house classes of Cohonina architecture represent temporary summer habitations and his own contention that Cartledge's deep pit house class represents winter habitations. Samples based this latter argument on the more robust construction of deep pit houses, presence of hearths, and a cross-cultural study examining pit structure use and environment (Gilman 1987) that suggests pit houses are most often utilized as winter residences as part of a biseasonal settlement pattern (Samples 1992:123,126-127).

When Schubert investigated the mobility/seasonality problem, he examined the relationship between elevation, biotic community and the distribution of habitation versus logistical sites. He found that sites with habitation features occur more often in the Rocky Mountain Montane/Petran biotic community, while logistical sites occur more often in Great Basin Conifer woodland. Further, habitation sites are consistently higher up than logistical sites. Finally, when he examined the relationship between site distribution and summer/winter precipitation, Schubert found habituation sites occur in areas that receive the majority of their precipitation in the winter and logistical sites occur in areas that receive the majority of their precipitation during the summer.

Taken together the evidence appears to support the notion that a considerable degree of mobility was part of Cohonina subsistence. However, there is considerable disagreement as to what this mobility actually looked like and the kinds of distances Cohoninas would have had to cover in order to take advantage of elevation-temperature-precipitation clines. McGregor (1951:141, 1967b:126) speculated Cohoninas were travelling as far as the Lower Colorado River Valley or the lower reaches of Havasu Canyon on the winter leg of their annual round from areas around Red Lake and Red Butte, distances between 125 and 225 km (78-140 mi). Samples (1992:148) suggested instead that members of the Sitgreaves Community only had to go as far as Red Lake on the summer leg of their biseasonal round, a distance of about 20 km (12 mi). Sullivan (1995) suggested that Cohonina may have been highly mobile, ranging quite far within resource catchments. Lastly, Cartledge (1986:105) argued the Cohonina could have been essentially sedentary, being able to meet their subsistence needs within a comparatively limited range.

Schubert's analysis provides strong evidence in support of some seasonal mobility, or at least some distance between where Cohoninas lived and where they worked. How far the members of a Cohonina household would have to go in order to access gathering and hunting opportunities, and perhaps summer gardens, in piñon-juniper woodland from their homes amongst the ponderosa pines is another matter. That distance is dependent on the amount of topographic relief around their settlement. I noted in Chapter 2 that precipitation is tied to elevation and the occurrence of any one biotic community is dependent on precipitation. Stands of ponderosa pine occur in areas with adequate water between 1,524 meters (5,000 ft) and 2,438 meters (8,000 ft), and piñon-juniper woodland occurs below 1,524 meters (5,000 ft). On the Coconino Plateau the two communities interdigitate extensively along their boundaries, often in the presence of limited expanses of Great Basin Grassland communities. Within the San Francisco Volcanic

Field, transitions from ponderosa forest to piñon-juniper woodland can occur over very short distances because volcanic hills and mountains create dramatic topographic relief. In the case of the Sitgreaves Community, resident Cohoninas would only have to walk about 5 km (3 mi) from their ponderosa shaded homes to reach extensive areas of piñon-juniper woodland and grasslands in Spring Valley. Thus long distance or even intermediate distance mobility is not required to account for Cohonina settlement; meaning mobility in Cohonina subsistence was decidedly local in nature.

Defining the Cohonina Fort

Colton's Cohonina architectural class referred to as "forts" is a specific focus of this thesis. Thus it is advisable to examine the history of the fort concept and how it has evolved over time. The fort concept is traceable to the very beginning of Colton's archaeological work in Northern Arizona (Wilcox 2011). In 1916 Colton and his wife Mary-Russell Ferrell Colton conducted an archaeological survey around Flagstaff while on vacation. The published results (Colton and Colton 1918; Colton 1918) include three sites at Fortress Hills, Turkey Tanks, and New Cave Mountain they designated as forts. Later, Colton identified sites situated on or just below peninsulas overlooking Walnut Canyon as forts (1st through 5th Forts [Colton 1932]). The Colton's based their defensive conclusions on four site characteristics: topographically elevated locations, restricted access, exceptionally thick walls, and relation to strategic resources such as arable land and water (Colton and Colton 1918:116, 118, 122). Colton (1918:12) argued that sites exhibiting these features were either forts of refuge wherein defenders temporarily retired during an attack, or forts of habitation wherein defensively minded people habitually resided. All of the forts described by the Coltons are positioned on hilltops or peninsulas formed by stream meanders, both of which form cliffs, ledges, or bluffs that provide considerable vertical offset from the surrounding landscape. Access to these sites was restricted by means of walls constructed across points of easy ingress/egress. This characteristic is best illustrated at the Turkey Tank Fort where access to a small peninsula was restricted by two walls built across a narrow neck of land connecting the peninsula to the mainland. The Coltons also pointed out that these walls are exceptionally thick, between two and four feet thick, implying they functioned as defensive strong points from which to repulse attackers or protect the fort's occupants. Finally, the Coltons observed that these sites were either located far from water as in the case of Fortress Hill Fort, or were positioned immediately adjacent to permanent water as in the case of Turkey Tank Fort.

Between 1930 and 1932 the MNA excavated a number sites in the vicinity of Flagstaff Arizona under the research goal of better characterizing the Pueblo II period. These efforts focused on recording ceramic and architectural data, and recovering dendrochronological samples in order to extend the tree-ring chronology to dates earlier than A.D. 700. Part of that work involved investigations at a site with masonry architectural remains (NA862, NA863, NA1680, NA1239) near the head of Medicine Valley, north of Flagstaff, Arizona. An exploratory test produced charred beams and ceramic types dating to the Pueblo II period. These finds made the site an ideal candidate to further their research agenda, hence a full excavation was undertaken (Hargrave 1933:49). Hargrave dubbed NA862 "Medicine Fort", making it the first fort systematically excavated in the region.

Medicine Fort is situated on a low rise below the northeast flank of Medicine Crater. Immediately to the west of the site, a sink forms a small cliff. Hargrave (1933:49) described this topographically elevated setting with partially restricted access to the west as "naturally fortified". He also observed that at the time of excavation reliable water was at least two miles away, but assumed a nearby source must have existed in the past. Thus Hargrave satisfied three of the Colton's fort definition criteria. NA862 was elevated above the surrounding landscape, the topography provided naturally restricted access, and he insisted a reliable source of water was nearby at the time of its use.

Hargrave described the walls of NA862 as unusually thick and constructed with unshaped cobbles of volcanic stone set in copious amounts of mud mortar. The plan view of the building consists of a large rectangular area enclosed by thick masonry walls. Attached to the east side of this main enclosed area were three smaller rooms, only one of which exhibited a doorway. Hargrave's excavation indicated the majority of the building was originally roofed, excluding a narrow parallelogram in the center of the main enclosure (Hargrave 1933:49-50). The floor under the central opening had three small areas of wood ash where cooking or heating fires burned, although no firepits were found. Hargrave likened the general characteristics of the building to a Mexican patio surrounded on four sides by *portales* or roofed arcades. Thus Hargrave satisfied the fourth criteria of the Colton's fort definition: NA862 had walls approximately four feet thick.

Hargrave also suggested that NA862 had substantial storage capacity, thus adding a fifth defining characteristic to forts. He reports that the three eastern rooms were used solely for storage, because no fire pits were located within them while numerous storage jars and baskets containing foodstuffs (maize, beans, etc.) were. He also reports that about twenty large storage jars were found under the *portales* roof in the patio section of the building, only one of which contained foodstuffs, suggesting the others held water. In addition to these storage features, NA862 also had a large clay-lined storage pit in the floor of the patio section, along the west wall.

Apparently unsatisfied with meeting the above criteria to define NA862 as a fort, Hargrave engaged in a lengthy argument that NA862 also sported parapet walls that were likely loopholed. The basis of this argument lies in his architectural analysis of the roof. He argued the arrangement of posts immediately against the patio walls suggested the *portales* roof was a standalone structure, independent of the walls, and supported by those posts. Hargrave suggested this would have allowed NA862's architects to extend the walls above the roof, at once creating a loopholed parapet and a firing platform provided by the roof. He went on to argue that the eastern store rooms were constructed in a similar manner, but not as high. Hargrave suggested this arrangement was intentionally defensive in that it created a double parapet wall towards the east where natural fortification was weakest due to a gradual slope.

The parapet argument became the driving piece of evidence in Hargrave's conclusion that NA862 was a purpose built fortification, over and above the Colton's definition and his own storage criteria. However, Hargrave (1933:50) admitted in Figure 3.19 that the walls of NA862 were preserved only to a height of about four feet, underscoring the fact that no direct evidence of parapets or loopholes actually existed. Harold Gladwin (1943:10-11) doubted Hargrave's interpretation of NA862 in a critical review of Colton's 1939 synthesis, suggesting instead it was simply a small pueblo.

Gladwin (1944:27-34) later latched onto to the speculative nature of Hargrave's architectural analysis at NA862 to drive a full blown attack on that site's designation as a fort. Gladwin pointed out that Hargrave's defensive argument for NA862 relied almost entirely on circular reasoning wherein his *portales* roof confirmed his parapet walls and his parapet walls confirmed his *portales* roof, and both confirmed his loopholes. He went on to demonstrate that all three architectural features were, by Hargrave's own admission, purely speculative. When these speculations were removed, said Gladwin, all one had was an exceptionally thick walled small pueblo. Gladwin's criticism of Hargrave's analysis was part of his broad attack on the Douglass method of dendrochronology and the Colton school of archaeology. This attack sought to undermine Colton's cultural taxonomy and the chronological methods it was based on, but also seriously undermined the Cohonina fort as a valid architectural class.

Colton (1946) continued to use forts as a defining characteristic of the Cohonina and explicitly rejected Gladwin's criticisms of Medicine Fort out of hand (Colton 1946:84). He later insisted (Colton 1946:274) that Medicine Fort was indeed a purpose built fort of refuge by simply regurgitating Hargrave's earlier interpretation without any new critical analysis. He extended that interpretation to two sites that were excavated (NA1765, NA3577) and to two other unexcavated sites with similar architectural qualities (NA2076, NA4154[a.k.a NA1608]). Colton (1960) later reiterated his defensive interpretation of the Cohonina fort concept and anticipated Schwartz (1966:478-479) when he argued that the need for forts lie in unstable Cohonina-Kayenta-Sinagua relations marked by episodes of conflict in the period after A.D. 1000. He maintained his functional interpretation of Cohonina fort sites as defensive structures meant to guard travel corridors at frontier zones. Colton again relies almost wholly on the by now entrenched view that Medicine Fort (NA 862) was a Cohonina defensive installation guarding the Cohonina-Sinagua border at the head of Medicine Valley. Colton extended this defensive interpretation of Cohonina forts to similar sites at Pittsberg and O'Leary Mesa (Colton 1960:61-63).

McGregor (1951) elaborated upon the Cohonina fort described earlier by Hargrave and Colton (Hargrave 1933; Hargrave 1938; Colton 1946). He noted these structures exhibited very thick masonry walls associated with a string of long, narrow rooms. These "long rooms" were either unattached masonry and jacal structures positioned at an angle to the fort proper, or attached to one side of the fort as masonry rooms. His addition of the long room to the Cohonina fort definition recalls Hargrave's proposition that storage was a major concern for fort architects. That these long rooms could be attached or unattached is based on the situation at NA862 and NA5145 respectively, the latter of which he excavated during the 1949 expedition. McGregor (1967b:305, 377), like Euler (1963:83) was apprehensive about inferring function for this class of architecture although he agreed in a roundabout way that they had a public function. However, he declined to challenge Colton's defensive interpretation of Cohonina forts.

Cartledge devotes some effort to critiquing the Cohonina fort concept in his 1986 synthesis. As noted above, the Cohonina fort concept dates back to the Colton's (Colton and Colton 1918; Colton 1918) earliest surveys around Flagstaff, but the forts described in those publications are now recognized as Sinagua rather than Cohonina and do not look at all like features currently identified as Cohonina forts. Hargrave (1933), Colton (1946) and later Garcia (2004) all argued Cohonina forts actually were purpose built defensive installations. However, these arguments are based almost solely on Hargrave's (1933) excavation and rather tenuous interpretation of Medicine Fort as a purpose built Cohonina fort of refuge guarding the Head of Medicine Valley along the Cohonina-Sinagua border. Colton (1939, 1946, 1960) helped to codify this architectural taxa and it has been entrenched in Cohonina literature ever since. Cartledge attempted to jettison the fort concept once before (Cartledge 1979) and again in his Cohonina synthesis

(Cartledge 1986) arguing both times that besides incredibly thick walls, sufficient data does not exist to support a defensive function for these features. He cited differences in construction material, layout, and size of features labeled as forts to suggest this architectural class is masking considerable variation. He also questions the defensibility of fort locations, pointing out that most do not exhibit especially restricted access in terms of topography or architectural features which of course violates a key part of Colton's definition of a fort.

Cartledge acknowledged that Kaibab National Forest (KNF) surveys recorded the existence of several surface features readily assignable to the "fort" class of Cohonina architecture, meaning they are large, rectangular features with sufficient rubble to suggest massive "full-height" walls (probably meaning 2m or more in height). These sites are invariably located in elevated positions and Cartledge noted the existence of four forts with lines of intervisibility between them, although he does not cite the specific sites. He used these observations to suggest Cohonina forts were actually "nodes in a communication network involving the use of signal fires" (Cartledge 1986:99). The major implication here is that Cohonina forts served a "public" function in that they integrated disparate locations by providing a locus for symbolic behavior meant to be seen from a distance. However, Cartledge appears not to have grasped the ramifications of that implication, being content to merely undermine the defensive interpretation of forts. Hanson (1999) recapitulated Cartledge's alleged communication network in his cultural affiliation statement for the KNF (see Chapter 4); however, neither researcher rigorously investigated whether or not sites within these proposed networks were contemporaneous, whether or not lines-of-sight are merely a coincidence of some environmental factor such as topography, nor do they develop pathways to determine if those lines-of-site reflect intentionality on the part of Cohonina architects. Finally, they do not build the middle-range theory necessary to link this speculated unobservable past human behavior to relevant ethnographic examples through the medium of material culture.

In a study of Cohonina public architecture Bone (2002) investigated several characteristics of Cohonina fort sites such as location, occupation date, total enclosed space, room contiguity, number of habitable rooms, and the degree of variety found within ceramic assemblages. In a sample of ten known Cohonina fort sites he did not find any significant difference in these measures. The first major contribution of this study is Bone's (2002:93) demonstration that forts occur in all subregions of the Coconino Plateau; meaning they were a ubiquitous feature on the Cohonina landscape. Secondly, Bone (2002:122) found that all Cohonina forts were more or less contemporaneous, with temporal designations clustering around A.D. 1050. Thus Cartledge's contention that the fort class of Cohonina architecture is masking considerable variation appears unsupported. The major implication of this study is that it demonstrates there was a considerable degree of uniformity in the way forts were built and when. Although Bone's study presents a substantive contribution towards understanding Cohonina forts as public architecture, he declined to investigate the specific public function/s of forts.

The Mobility and Mountain-centric Models of Cohonina Social Organization

Cartledge attempted to apply his findings on Cohonina settlement/subsistence towards building a new model of Cohonina social organization and exchange. This new model directly contradicts that of McGregor's in that it stresses sedentism and exchange rather than mobility. McGregor's model of Cohonina social organization argues these folk organized themselves as small, autonomous bands that roamed around the Coconino Plateau in a more or less even distribution, moving from one resource patch to another in a bi-seasonal round. It also models the Cohonina as a culturally homogenous folk unified under a common ethnicity and trading with their Sinagua, Cerbat, and Kayenta neighbors as opportunities arose. Cartledge saw considerable problems with the "Mobility Model" and sought to undermine it from a variety of angles.

He first rejected the notion that the Cohonina were more or less evenly distributed across the landscape. He pointed to the distinct clustering of Cohonina sites in piñon-juniper woodland and around prominent topographic features within that biotic community as primary evidence.

He argued these mountain-centric site clusters are the remains of localized, relatively autonomous Cohonina groups who “operated within territorially limited, perhaps culturally recognized, portions of the plateau” (Cartledge 1986:105). The major implication of this model known as the “Mountain-centric Model” is that it implies a greater degree of sedentism than McGregor ever considered for the Cohonina. Cartledge (1986:102) cites the close proximity of the various classes of Cohonina architecture so far identified as evidence of year-round occupation within mountain-centric clusters. He suggests the close proximity of deep pit houses, substantial masonry structures, and more ephemeral ramadas, and brush huts mean Cohoninas maintained a year-round presence within their communities, moving between architectural types as seasons and economic activities cycled.

He also suggested that variability between subregions in terms of artifact and architectural types supports the Mountain-centric Model (Cartledge 1986:105). He points to restricted distributions of double-walled structures around Bill Williams Mountain, deep pit houses around Sitgreaves Mountain, and possible house-mounds around Kendrick Mountain as possible evidence of locally learned architectural traditions. Cartledge also pointed to non-uniform distributions and considerable variation in projectile points as evidence of local autonomy. Finally he suggested that variation in the San Francisco Mountain Gray Ware tradition might reveal evidence of localized manufacturing techniques. He goes on to argue that local autonomy might have led to greater social ties with neighboring regions than with other Cohonina communities.

Samples’ (1992) analysis of the Sitgreaves settlement system provides some insight into how these communities were internally organized. I noted earlier in discussions about Cohonina architecture and settlement patterns that Samples found patterning in the locations of different types of architecture. Following Cartledge’s (1986:107) suggestion, Samples regarded single pit houses or single pit houses with an associated masonry/jacal structure as representative of the simplest level of Cohonina social organization, which he interpreted as the single family household (Samples 1992:135). He also argued that extra large pit houses were most likely communal structures that integrated Cohonina society above that of the single household. Samples interpreted the distinct clustering of his single household units around thirteen extra-large pit houses as representing extended family groups. He also argued that Cohonina social organization went beyond that of the extended family group. Two walled plaza sites are located within in the densest portion of the Sitgreaves settlement system and Samples argued these sites were the locus of behavior that integrated the Sitgreaves Mountain Community as a whole (Samples 1992:142).

Bone (2002) set out to test whether or not the Cohonina were actually multiple culturally unrelated groups occupying the Coconino Plateau. He found that across the plateau, the Cohonina, had similar access to trade wares, built similar sized public edifices, and those public places integrated similar numbers of people. Bone took this to mean the Cohonina actually were culturally unified in some way, which appears to support the Mobility Model. However, Bone reported significant differences in the types of Cohonina public architecture between subregions, lending support to the Mountain-centric Model. Still the ubiquitous presence of Cohonina forts throughout the plateau indicates a regionally recognized form of social integration. Taken together, these lines of evidence suggest that, despite evidence of autonomy in architecture, settlement data (Samples 1992), projectile point technology (Horn-Wilson 1997), and ceramic traditions (Sorrell 2005), the structure of Cohonina social integration exerted substantial unifying forces on what would otherwise be independent communities prone to increasing segmentation.

Despite the substantial evidence of local autonomy, Cartledge (1986:110) too sensed the Cohonina were somehow integrated on a regional level and must have shared a substantial degree of cultural cohesion, as evidenced by the San Francisco Mountain Gray Ware tradition (Colton 1946; Carter and Sullivan 2007; Carter et al. 2011) and ubiquitous presence of forts in the Cohonina region (Wilcox 1995; Bone 2002). He reconciles this pattern of regional consistency and local autonomy in a discussion of his exchange subsystem. Cartledge reasoned that unless the Cohonina were substantially different from every ethnographically known group of people, then vigorous exchange played a major role in the formation of group identity and ties of affinity. He argued just such a plateau wide exchange system existed which provided the means to integrate the various Cohonina subregions. Cartledge suggested that differential access to key commodities on differing time scales, from seasonal to multi-decadal, created routes of exchange that in turn structured interaction and integration between communities and between regions.

Cartledge argues that trade was the key integrative subsystem in the Mountain-centric model of Cohonina social organization, but admits almost nothing is known about it, besides the widespread presence of Kayenta ceramics on the Coconino Plateau (Cartledge 1986:107-110). McGregor (1967a), Schwartz (1966), and Colton (1960) all looked to the Havasupai as a cultural analogue in their discussions of Cohonina exchange, but this practice is unacceptable for a variety of empirical and theoretical reasons (Martin 1986; Hanson 1999; Trigger 2006:307-308). On the Cohonina side of regional exchange Cartledge reiterated the evidence of long term and robust trade in ceramic vessels to their neighbors, but like McGregor before him he was unable to elaborate on the nature of that exchange other than suggesting that those Cohonina communities closest to extra-regional trade routes stood to benefit most from that proximity as initial recipients of trade.

Cartledge diverged from his predecessors when he nominated two other raw materials as potential trade commodities. The first of these is obsidian and forms the basis for his notion of differential access to key commodities. Cartledge (1986:108-9) pointed out that tool quality obsidian sources are locally restricted on the Coconino Plateau, but material from these sources are nevertheless found throughout the Cohonina region as well as Northern Arizona. He argued that communities closest to these sources could have controlled access and presumably trade in this most basic economic material. For example, the Government Mountain source is closest to the Sitgreaves community, meaning they may have controlled its flow through trade networks to other Cohonina communities and more far flung locales.

Shackley (2005) produced a major synthesis of Southwestern obsidian source provenance studies which contribute substantially to understanding the structure of prehistoric obsidian trade and how the Cohonina fit into it. Shackley (2005:29-36) cites the existence of ten obsidian sources in the Cohonina region, seven of which are suitable as tool stone (Roberts 2008). Three tool quality obsidian sources are clustered around Sitgreaves Mountain and may have been controlled by the residents of that community: Sitgreaves, RS Hill, and Government Mountain obsidians. The latter source was one of the most "popular raw materials for chipped stone tool production in the entire Southwest from Paleoindian times through the historic periods" (Shackley 2005:34), and thus is one of the most informative on regional exchange. In a study of Hohokam gender/identity Shackley combined his obsidian source provenance analyses and a techno-stylistic analysis of Hohokam projectile points by Hoffman (1997). The results of this study implicate the Cohonina in a far-flung Preclassic trade network that linked the Coconino Plateau to the Lower Salt River Valley via the previously mentioned Hohokam ballcourt network.

The basis for this argument lies in a set of projectile point studies that found Coconino Plateau obsidians dominate assemblages from Hohokam sites that lie within Hoffman's "Solares" toolmaking tradition (Shackley 2005:162). In contrast, Hoffman's two other toolmaking making traditions (Santan and Gatlin/Citrus) are each dominated by non-overlapping local sources. Many of the projectile points made of Coconino Plateau obsidians (especially the Government Mountain source) that are recovered from Solares tradition sites bear a striking resemblance to several of Horn-Wilson's (1997) Cohonina styles (Shackley 2005:166, Figure 3.8.16). Taken together, Shackley argues this evidence indicates trading relationships facilitated by ball court marketplaces (see above) furnished a specific sub-group of Hohokam with finished arrows, or at least finished projectile points, produced by the Cohonina residing 200 km to the north (Shackley 2005:164, 169). This Cohonina-Hohokam exchange system apparently broke down when the ballcourt network began to disintegrate between A.D. 1070 (Abbott el at. 2007:471) and A.D. 1200 (Wilcox and Sternberg 1983). At La Ciudad, a Solares tradition site, Coconino Plateau obsidian is not present after the end of the Preclassic (Shackley 2005:164), nor is it present elsewhere in the Phoenix Basin after that time. This time period coincides precisely with the period of massive settlement shifts out of the Cohonina core (Garcia 2004; Weintraub et al. 2005).

The second basic commodity Cartledge implicated in Cohonina exchange was piñon nuts. He had already suggested this food source may have played a central role in subsistence, but went further in suggesting it could have been traded in high volumes within and without the Cohonina region. As with obsidian, Cartledge's focus on piñon nuts lies in their uneven distribution on the Coconino Plateau over time and through space. Piñon nuts mature every 26 months, but individual stands mature at different intervals and those intervals can be disrupted by a variety of environmental factors ranging from drought to insect infestation (Lanner 1981). Ethnographically, variability in piñon nut production is checked by the long shelf life of roasted nuts (approximately 3 years) and the ability of harvesters to predict yield quality in any one stand one to two years in advance, often with a high degree of accuracy (Lanner 1981; Sullivan 1992:200). However, if poor yields outstrip storage capability, scarcity would develop in the piñon nut supply in those communities that experienced a series of bad harvests. This scarcity, Cartledge argues, would have been mitigated through intercommunity trade networks moving surplus piñon nuts from areas of high supply to those of low supply, both of which would have been known well in advance. He also suggests that piñon nuts could easily have been traded to neighboring regions who did not have access to them, thus implicating them as a potentially high value commodity.

Taken together, Cartledge's Mountain-centric Model proposes a model of Cohonina political economy that differed substantially from that of McGregor's (1951, 1967). McGregor argued the Cohonina were organized around an economic base of gathering, hunting and agriculture arranged in a seasonal round, whereas Cartledge (1986:100, 104-105, 109-110) proposed Cohonina political economy was organized around gathering, hunting, agriculture, and more importantly trade, arranged around territorially limited groups occupying the slopes of major mountains. The major implication of Cartledge's Mountain-centric Model is that seasonal mobility was not a major feature of Cohonina adaptation. Instead, he argues trade relations structured the movement of basic economic commodities within a Cohonina regional system and between the Cohonina and their Cerbat, Sinagua, and Kayenta neighbors. Therefore, Cohonina groups could establish and maintain land tenure year-round, and over several generations, make considerable investments in place as evidenced by forts, plazas, ballcourts, and extra-large pithouses, all without localized scarcity of basic economic commodities necessitating a highly mobile existence.

This exchange system would have provided the economic scaffold upon which a regional integrative symbolic system could develop; one that ensured the maintenance of Cohonina society by allowing the various Cohonina communities consistent access to information, potential spouses, and the basic materials of life from piñon nuts to maize and obsidian. However, Cartledge (1986:107) was somewhat equivocal on this model stating that some seasonality may have existed in the form of seasonal co-residence alternating with dispersal in his discussion of the basic Cohonina social unit, which he assumed to be the nuclear family. He contradicts his community model again in a discussion of burial practice, arguing that the dearth of known Cohonina burials is not surprising given they "lived in small groups and were very mobile" reducing the probability of "death occurring during the occupation of a particular site" (Cartledge 1986:115). These statements are difficult to reconcile with his Mountain-centric Model because the latter implies a fairly rigid dissection of the landscape along lines of land tenure maintained by individual communities and recognized on a regional scale, which precludes the use of high mobility as an adaptive strategy.

Summary

This chapter described the development of the Cohonina concept from its genesis to contemporary thought. The notion that Cohonina archaeology is something of a backwater of archaeological research was dispelled. On the contrary, Cohonina research exhibits significant parallels with trends in the discipline generally and Southwestern archaeology specifically. This effort provides a backdrop from which to critically assess the Cohonina fort concept and the archaeological data produced by the MNA 1938 field expedition this thesis relies on. Inquiry into the history of archaeological thought on the Cohonina also revealed that Cohonina researchers were, and still are, significantly influenced by the academic allegiances they claim and the interpretive agendas they find themselves embedded in. However, the preceding discussion demonstrates that a steadily accumulating corpus of archaeological facts is acting to constrain interpretation and blunt the deleterious effects these influences have on our ability to recover that which has been forgotten on the Coconino Plateau.

The evidence marshaled above indicates the Cohonina concept is a valid taxonomic category and a sound foundation upon which to conduct archaeological research. Contrary to long standing interpretation, Cohonina culture evolved out the Basketmaker tradition of the Colorado Plateaus and followed a historical trajectory that paralleled and articulated with other Ancestral Puebloan societies. Drawing on the preceding literature it is also possible to outline two models of Cohonina socio-political organization. The first known as the Mobility Model is traceable to John McGregor and supported by contemporary researchers such as Terry Samples and Alan Sullivan. This model proposes the Cohonina utilized an adaptive strategy of bi-seasonal mobility to ensure their survival as part of a mixed economy that incorporated some horticulture, but was heavily dependent upon collecting wild resources. The second model known as the Mountain-centric Model is traceable to Thomas Cartledge and most recently supported by John Schubert. This model proposes the Cohonina were organized as essentially sedentary mountain-centric communities who practiced a mixed economy, but relied heavily on inter- and extra-regional exchange to maintain their economy and social cohesion. Each model has important implications for Cohonina research and thus provides a testing ground from which to launch new inquiries.

The 1938 MNA expedition led by Lyndon Hargrave is of profound importance to this thesis specifically and to the world of Cohonina archaeology generally because it was the first Cohonina specific research program carried out since that archaeological culture was first recognized in 1937 (Hargrave 1937), and that it provides the primary source of excavation data and a series of dendrochronological dates for the project area. Despite the fact that data from NA3577, located within the current study area, have been incorporated into a number of papers (Adams

2002; Ahlstrom 1983; Bone 2002; Cartledge 1986; Colton 1946; Horn-Wilson 1997; McGregor 1951; Robinson et al. 1975; Downum 1988; Robinson and Cameron 1991; Schubert 2008; Shackley 2005; Sorrell 2005), a comprehensive study of that site relative to its surroundings has not occurred until now. This has led to some confusion about the site. The preceding effort indicates NA3577 cannot be characterized as a Cohonina community in and of itself. In actuality it represents only one component of the larger a larger settlement system, its public architecture. For these reasons and to avoid future confusion, I refer to this complex of structures (NA3577, 03070100889) as the "Pittsberg Fort Complex" (PFC) and jettison "village" as an operational term completely.

In the period after 1975, research conducted by Kaibab National Forest archaeologists came to dominate Cohonina archaeology. Although Thomas Cartledge attempted to drive Cohonina research within a processual framework, the historical exercise above indicates the latest period of Cohonina research is firmly rooted in settlement archaeology and thus belongs to a behaviorally oriented school of thought somewhat different from processual archaeology. Settlement archaeology produces data most amenable to the policies governing the administration of public lands and the dominance of KNF archaeologists in terms of data production means most new studies in Cohonina archaeology come from a settlement archaeology perspective. Thus any new research in Cohonina archaeology must court that body of theory. However, rather than creating a roadblock to innovative research, the theory driving settlement systems analysis is readily adapted to contemporary theoretical perspectives; meaning Cohonina archaeology is well positioned to continue contributing to the understanding of Southwestern history.

CHAPTER 4: THEORETICAL ORIENTATION AND METHODS

Theories are narrow constructs that focus on the understanding of one realm at the expense of many others (Hegmon 2003). In order to account for the specific, but nonetheless complicated, phenomena of Cohonina forts I must assemble a number of these constructs in order to build an explanatory argument that aspires to illuminate the past as it actually was, rather than how I perceive it. This task has a better chance of success when one understands the origins, successes, and failures of theories employed and how those understandings have changed over time. Thus the historical inquiry of Chapter 3 into the methods and modes of knowledge production within Cohonina archaeology provided the foundation and raw material out of which I will assemble the appropriate building blocks capable of supporting my explanatory argument. This chapter moves forward with that effort by providing a theoretical orientation for this thesis through a description of two closely related bodies of theory and how they will guide the collection of data, its analysis and interpretation.

I begin with a description of a behaviorally oriented body of theory known as settlement archaeology which is traceable in North America to Julian Steward and Gordon Willey (Willey 1953). At its core, the practice of settlement archaeology involves cartography, archaeological chronology, and functional analysis. Thus I develop linkages between settlement archaeology and contemporary theory concerned with Geographic Information Systems and the practical exigencies of consuming settlement systems data derived from government agencies. I then move on to a Cohonina specific discussion of archaeological chronology.

I then describe a cognitively oriented school of thought known as landscape archaeology which is traceable to Ian Hodder (1984). Landscape archaeologists seek to access past perception and symbolic meaning tied to the natural and built environment; and the recursive relationship between social structure, landscape, and agency. This broadly postprocessual and cognitively oriented approach articulates well with the behaviorally oriented functional analyses of settlement archaeology. Thus it provides greater theoretical support to the effort of understandings the roles that the built environment played in Cohonina social reproduction; that is, the reaffirmation of existing structures (Murray 1996). I discuss how to articulate settlement archaeology and landscape archaeology within the realm of GIS, with the hope of working towards a more comprehensive theoretical framework.

Finally I appropriate aspects of a considerable tradition in Southwestern archaeology that seeks to identify and rigorously explain the function and meaning of public architecture (Lipe and Hegmon 1989b; Neitzel 1999) and its role in regional integration and interaction. This body of knowledge provides the means to access ethnographic data in terms of Binford's middle-range theory, points to attributes of public space that ought to be studied while operationalizing key concepts such as, "ritual facility", "public architecture", and the like. The archaeology of public architecture also provides another theoretical bridge between settlement archaeology and landscape archaeology because questions of behavior and meaning are inevitably asked. The answers to those questions are sought in floor assemblages, architectural variability, settlement patterns, and the symbolic systems coded therein.

The final section of this chapter discusses the specific methods of survey and archaeological chronology used during the course of this investigation. I also engage a set of theoretical tools and analytical devices specific to conducting visibility analysis with Geographic Information Systems (GIS). I use these techniques when I approach the problem of understanding the symbolic linkages between forts, their elevated positions on the landscape, hills and mountains as community symbols; as well as accessing the meaning and intentionality of line-of-sight connections and the role they played in the symbolic system of Cohonina forts.

Settlement Archaeology, CRM, and GIS

The historical basis of settlement archaeology in North America is traceable to Steward and Seltzer's (1938) article wherein they admonished Americanist archaeologists to strive to elucidate culture process. They argued the functional characteristics of artifacts, the arrangement and density of houses and villages on the landscape, and the relationship between economy and environment all have the potential to contribute towards that goal by revealing change in subsistence economy, demography, and settlement pattern. They also pointed to survey as an indispensible step in gathering the information necessary to examine the functional relationships between these cultural elements (Steward and Seltzer 1938:8).

Steward convinced G.R. Willey to put these ideas into practice by conducting a settlement-pattern survey as his contribution to the combined Virú Valley investigations in Peru (Willey 1953; Willey and Sabloff 1974:148). Aerial photographs and pedestrian site checks were used to locate and map hundreds of sites within the valley. Analyses of surface collected ceramics and vertical excavations provided the investigators with chronological control. Sites maps were prepared in order to infer the functional characteristics of architectural remains. Finally, these lines of inquiry were combined into a series of maps that showed which sites were in use during successive phases of Virú Valley history. These three concerns of producing accurate settlement maps, establishing chronological control, and inferring site function lie at the core of settlement archaeology then and now. Trigger (2006:379) describes Willey's approach as "the most important innovation since [Christian] Thomsen had succeeded in periodizing history". Collectively, settlement maps, chronology, and site function characterize a settlement pattern which Willey defined as:

> the way in which man disposed himself over the landscape on which he lived. It refers to dwellings, to their arrangement, and to the nature and disposition of other buildings pertaining to community life. These settlements reflect the natural environment, the level of technology on which the builders operated, and various

> institutions of social interaction and control which the culture maintained. Because settlement patterns are, to a large extent, shaped by widely held cultural needs, they offer a strategic starting point for the functional interpretation of archaeological cultures [Willey 1953:1]

The importance of this definition lies in its ability to link the residues of past human behavior to living social arrangements that are the necessary point of origin for all archaeological interpretation. The settlement pattern, as formulated, relates to the social arrangements between a set of people known as a community, or the boundary of daily social activities and space in which individuals engage one another; a realm they simultaneously structure and are structured by more so than any other social division (Chang 1968:2). Thus settlement patterns become the most basic unit of social analysis in archaeology because they are the remains of communities and contain within them the source of information on a wide spectrum of human behaviors that constitute the social and political economic organization of past peoples (Trigger 2006:377). Within an individual community the constituent parts of its settlement pattern reveal different aspects of organization and integration (Trigger 1968:55). For example, individual houses may shed light on kinship organization, whereas the arrangement of households, work spaces, and public structures within a community might reflect the organization of production, suprahousehold integration, and the boundaries of social space. Finally, the distribution of communities on the landscape strongly reflects the limits imposed by environmental factors and subsistence economy, and to a slightly lesser degree they might reveal aspects of regional organization and integration.

The successes of settlement archaeology worldwide are well attested (Willey 1956; Chang 1968; Willey and Sabloff 1974; Trigger 2006) and its application within the Cohonina region of the Southwest is well established (Cartledge 1979; Samples 1992; Schubert 2008). Schwartz (1956) attempted the first analysis of Cohonina settlement patterns in the context of examining demographic change, but this paper is flawed because it relies on casual rather than intensive survey and he never published the data his conclusions are based on (Cartledge 1986).

In Chapter 3, I noted that intensive settlement survey in-line with the methodological core of settlement archaeology did not occur in the Cohonina region until the 1970s. The use of these methods in the Cohonina region is directly linked to the Kaibab National Forest's (KNF) efforts to meet the requirements of the National Historic Preservation Act (NHPA 1966). Settlement archaeology's basic goals of creating settlement maps, building chronologies, and inferring site function articulate near perfectly with the NHPA's focus on identifying, cataloging, and protecting cultural resources on federally administered lands.

Settlement Archaeology and Federally Administered Cultural Resource Management

The articulation of public land policy and archaeological method created the impetus for large-scale pedestrian surveys within the National Forest System and other governmental organs in the mid 1970s. The Museum of Northern Arizona has kept records of site locations since the 1920s, but these records lack detail, are incomplete, or inaccurate; mostly due to their age and the cartographic/archaeological techniques employed at the time. The Arizona State Historic Preservation Office (ASHPO), Coconino National Forest (CNF), Bureau of Land Management (BLM), and National Park Service (NPS) all maintain databases adaptable to settlement research, but are less important than those of the KNF for several reasons. First, the ASHPO merely serves as a repository for data produced by cultural resource management projects, making it prudent to seek out primary sources instead. Second, whereas the other previously mentioned agencies' administrative boundaries happen to fall on the periphery of the Cohonina region, the KNF's boundaries encompass the overwhelming majority of that region; making it the primary steward of Cohonina archaeological data. I noted in Chapter 3 that Cartledge spearheaded the first efforts at conducting intensive block surveys of KNF land meant to identify, map, and characterize archaeological sites as part of the cultural resource management goals of that national forest. These efforts are ongoing today; meaning that with few exceptions all new research in the Cohonina region is of the settlement systems variety. Thus any new investigation into Cohonina archaeology makes use of that data and must court the theoretical perspective of settlement archaeology as a result.

Settlement Archaeology and Geographic Information Systems

The research potential of the Cohonina settlement dataset contained in KNF site files and electronic databases is enormous given its size, detail, and consistency. However, no single person is capable of handling this dataset effectively without the assistance of a Geographic Information System (GIS). Thus it is critical to understand what GIS is generally and how it fits into settlement archaeology in particular. While broad agreement as to what a GIS is (tool, theory, science) is lacking (Conolly and Lake 2006), it can be said that a GIS is a of collection software applications that allow the input, storage, manipulation, and display of spatial data. Fisher (1999:5) citing Cowen (1987) emphasizes context of use when he describes a GIS as an analytical environment that integrates spatially referenced data. In practice, archaeologists use GIS as a tool (Conolly and Lake 2006:3) while engaged in problem oriented research. Within settlement archaeology GIS becomes a powerful tool indeed, primarily because they are complementary in that both use geography as an analytical starting point and they are both predicated on similar geometries (topological and Euclidian), meaning they are theoretically congruent. Secondly, the capability of GIS to store, manage, manipulate, and display huge amounts of information, along with an impressive array of ready-made spatial analytical tools make GIS uniquely capable of addressing a wide variety of problem domains in settlement archaeology.

Both settlement archaeology and the use of GIS in archaeology have come in for criticism in the last two decades. These criticisms cluster around three themes: naïve application of spatial analytical tools, unwanted introduction of functional and/or environmental determinisms, and the imposition of Western-contemporary cognition/perception onto non-Western/non-contemporary mind. Mashner (1996a:303) pointed out that archaeologists sometimes examine the relationship between settlement and environmental data modeled in GIS such as soil, slope, biotic communities, and the like without having a sound grasp on the appropriateness of the statistical/spatial analytical tools they are using. Worse yet, these operations are sometimes carried out not as part of theory driven research, but simply because they are the only data and/or tools available. This is sloppy research at best and not related to inductive exploratory data analysis which has a valid place in archaeological theory building because it is hypothesis driven research (Maschner 1996a:302). However, GIS methods in archaeology have matured significantly since their first use in the late 1980s; meaning the before mentioned pitfalls have been significantly mitigated.

On a deeper level, both settlement archaeology as theory and GIS as method have been accused of focusing too heavily on ecological factors in archaeological research. A great many researchers (Maschner 1996b:11; Fisher 1999:9; Conolly and Lake 2006:9; Brück and Goodman 1999:8) have issued stern warnings that when an overly ecological perspective is taken, settlement archaeologists and GIS users unwittingly promote an environmentally deterministic explanatory mode that is now generally unacceptable within the discipline (Maschner 1996; Trigger 2006:440). However, the abandonment of the notion that "ecological explanations can account for all or most of the archaeological record" (Dean et al. 1986; Trigger 2006:485), has led to a renewed interest in ecological possibilism/probablism; that is, addressing ecology and human decision making without making the former a prime mover. GIS informed settlement archaeology has much to offer this approach (Fisher 1999:9). As things stand now, a fear of determinisms, ecological or otherwise, in GIS applications or settlement archaeology might be much ado about nothing, especially given that no right minded archaeologist would suggest that human decision-making was never made in response to environmental conditions.

On a still deeper level, some have leveled criticisms at both settlement archaeologists and GIS users alleging their reliance on Euclidian based perceptions of space strip the landscape of cultural meaning or impose Western perceptions of landscape on their subjects of study (Brück and Goodman 1999:8; Van Leusen 2002). While it is true that the current standard of relying on the Euclidian perception of space and the related Cartesian method of exploring space are not objective and have Western origins, they are however a standard. That standard is recognizable and understandable to the overwhelming majority of archaeologists utilizing settlement archaeology and GIS to drive their research, which is to say these perceptions and associated terminologies are tools-of-the-trade, critical to doing good science. No well informed archaeologist would suggest that Western notions of the people-landscape relationship and the meanings/perceptions they attribute to it are universal. However, without knowing the landscape perceptions/meanings or the structure of political economic organization of the long dead peoples whose material culture archaeologists study, settlement archaeology informed by GIS is a pragmatic and reasonable place to start.

Archaeological Chronology and the Cohonina

Establishing chronological control is another major goal of settlement archaeology. In Chapter 3 I discussed some aspects of Cartledge's (1986) Cohonina synthesis. One of the major contributions of that synthesis was a discussion of culture-history and problems revolving around the methods of archaeological chronology specific to the Cohonina region. He engaged in a critical examination of all Cohonina chronologies developed to that point and the data each is based on. Tree-ring dating and the related method of ceramic cross dating were and still are the dominant techniques of assigning temporal ranges to Cohonina sites. Cartledge pointed to several limitations in these techniques that have hampered efforts to construct a reliable and fine grained Cohonina chronology.

Dendrochronology and Ceramic Cross Dating

Dendrochronology underpins nearly all chronological efforts in the Northern Southwest and the Cohonina region is no exception. However, Cartledge (1986:81) citing Ahlstrom (1983) points out that technique is of limited use in the Cohonina region when only 200 tree-ring dates exist when thousands of Cohonina sites are known. The near legendary accuracy of dendrochronology goes unutilized when a relatively small number of tree-ring dates from Cohonina contexts are used to construct a regional chronology, especially when most of those dates cluster in six restricted areas and within a very short period between A.D. 1050 and 1130 (Ahlstrom 1983:2,17; Cartledge 1986:82). Gathering tree-ring data is also a costly affair in that it requires the excavation of features, collection of suitable wood samples, and analysis. This high cost helps explain why so few tree-ring dates exist for Cohonina contexts and that the majority of these were collected during the early period of Cohonina archaeology.

Cartledge identified the related chronometric technique of ceramic cross dating as particularly problematic in Cohonina contexts. Ceramic cross dating describes a method of archaeological chronology that uses the presence and absence of individual tree-ring dated ceramics to assign temporal designations to sites or features within sites. Typically, this is accomplished by arranging the production dates for ceramic types in a graph known as a “chronogram”. The presence and absence of those types in a ceramic assemblage is applied to the chronogram and the analyst looks for overlap in production dates to arrive at a date range for the assemblage. This method lacks the sophistication of ceramic groups and generally overestimates the length of temporal assignments. However, ceramic cross dating is an attractive chronometric technique in the context of settlement survey for two reasons. First, the temporal assignments are robust in that they rely on nominal level data, meaning there is little room for error in analysis as long as surveyors are well educated in ceramic identification. Secondly, the per datum collection cost in terms of time and effort is dramatically lower than most other chronometric techniques making it well suited to broad scale pedestrian survey.

Despite its attractiveness, ceramic cross dating does have certain theoretical and methodological pitfalls. Low frequencies of tree-ring dated ceramic types can hamper efforts to assign date ranges to sites. Cartledge pointed out this problem is particularly pronounced in the Cohonina region where the best dated ceramic wares (Tusayan Gray and White Wares, San Juan Red Ware, and Tsegi Orange Ware) occur in relatively low frequencies and temporal assignments are most often based on surface survey alone. For example, if a surveyor notes surface sherds of types that had long production runs such as Shato Black-on-White (Tusayan White Ware) and Clapboard Corrugated (Tusayan Gray Ware) the most confident temporal range they could assign by ceramic cross dating is on the order of 200 years. When tightly dated ceramic types are absent or assignable to ware only, a 400 hundred year interval is all that is possible. This kind of resolution would far and away overestimate the length of occupation of most Cohonina sites, making it difficult to recognize patterns of change on any scale of analysis.

Cartledge's second concern with ceramic cross dating in Cohonina contexts has to do with a traditional reliance on so-called "intrusive" or "trade wares" to date sites. The Cohonina index ware, San Francisco Mountain Gray Ware, is a poor candidate for ceramic cross dating because the production runs for its various types were quite long or are poorly understood. Cartledge points out that the Cohonina were consuming ceramic wares from their Cerbat and Sinagua neighbors, but these wares are not any more useful than San Francisco Mountain Gray Ware in terms of ceramic cross dating. Thus, every archaeologist from Hargrave on relied on ceramic types that were imported from the Kayenta Anasazi region. McGregor (1951, 1967a, 1967b) made a concerted effort to understand the dynamics of Cohonina-Kayenta exchange, but failed in that regard. Cartledge latched upon that considerable gap in knowledge and made the basic, but hitherto overlooked, observation that if Cohonina-Kayenta exchange had experienced disruptions or was cut off, it would call into question all temporal assignments based on Kayenta ceramics. This scenario is a definite possibility because there are Cohonina sites that date well into the 1100s based on tree-ring evidence, but lack Kayenta ceramics dating to that period (Cartledge 1986:87).

At its root the above observation questions what anthropological process archaeologists are actually dating when they use ceramic cross dating in Cohonina contexts based on Kayenta ceramic types. Ahlstrom (2008) citing Dean (1978) identifies four concepts (dated, reference, target, and bridging events) that researchers use in building inferential arguments in the context of archaeological chronology. In the case of ceramic cross dating two iterations of this dating argument are made, one having to do with dating ceramic production with tree rings and the other having to do with dating site occupation with ceramic production.

A "dated event" is an event that is directly dated by some technique. In dendrochronology the dated event is the growth of the last ring on a wood sample. When that final growth ring is present in a sample of wood (known as a "cutting date" or "death date") it is also a "reference event" or the event that will be used to date other events. When the final growth ring is not present (a "non-cutting date"), the dated event precedes the reference event by some unknown interval. The "target event" is some anthropological occurrence that the archaeologist wants to date. In the case of tree-ring dating ceramics, the target event is the production run of a particular ceramic type. Arrival at production dates requires accounting for the time elapsed and the series of events between the production of a ceramic vessel and its final deposition adjacent to a datable piece of wood in an archaeological context. These are "bridging events" and ones pertinent to tree-ring dated ceramics include the cutting of a tree, its incorporation into a building, placement of a ceramic vessel within that building, and the abandonment or destruction of the entire assemblage. This procedure has been carried out thousands of times in Southwestern archaeology to arrive at confident production dates for a great many ceramic types, but not those included within the San Francisco Mountain Gray Ware series.

The second iteration of this dating procedure in ceramic cross dating involves using ceramic production dates as reference events and establishing a series of bridging events to arrive at a target event which is usually the use of a feature such as a pit house or the duration of occupation for a site as a whole. In Cartledge's trade example the target date is site occupation, but he questions the bridging events invoked that place or do not place a ceramic sherd assemblage at a site. If Cohonina-Kayenta trade became attenuated or ceased altogether, an important bridging event has gone unaccounted for.

Mean Ceramic Dating and Mean Sherd Thickness Dating

Garcia (2004) examined boundary behavior in the context of the Cohonina-Kayenta-Sinagua shatter zone. He utilized Weighted Mean Ceramic Dating (WMCD) to establish chronological control in a diachronic study of broad scale spatial distributions of the three index wares attributed to the Cohonina (San Francisco Mountain Gray Ware), Kayenta (Tusayan Gray Ware), and Sinagua (Alameda Brown Ware) archaeological cultures. Mean Ceramic Dating (MCD) was originally developed within historic archaeology (South 1972), but a set of researchers soon adapted the technique to tree-ring dated Southwestern ceramic types. The technique considers the median production date of individual types and their relative frequencies in archaeological contexts to derive an estimated construction date for an individual feature. Christenson (1994) presented a synthesis of MCD's development in the Southwest and a refined methodology for its application in the Northern Southwest. Subsequent refinements in date ranges for specific types and alterations to the technique made by Downum (2003) resulted in WMCD which applies greater statistical significance to ceramic types with shorter production runs. The reference event for this technique is a point estimate for the formation of a ceramic assemblage in the form of sherds. The target event for WMCD is the construction of individual features within sites based on directly associated ceramic assemblages and has a 1-sigma error of twenty-six years when applied to Flagstaff area contexts in the period after A.D. 1050 (Garcia 2004:274; Downum, 2013 personal communication). Garcia used WMCD to assign dates to single component sites which were then parsed into one of six temporal periods.

WMCD has since become the chronometric technique of choice for theses emanating from NAU since 2004. In 2005 Daniel Sorrell completed a thesis at NAU which examined several attributes of San Francisco Mountain Gray Ware. In that study he used WMCD to develop the first chronometric technique based exclusively on Cohonina ceramic material. Specifically, Sorrell tested a long standing hunch among Cohonina field archaeologists that San Francisco Mountain Gray Ware vessels were built with increasingly thicker walls over time. He collected sherd thickness data (a proxy measure for wall thickness) from twenty-one tree-ring dated architectural contexts with directly associated assemblages of San Francisco Mountain Gray Ware and spanning a period between A.D. 834 and A.D. 1183. When mean sherd thicknesses of individual San Francisco Mountain Gray Ware assemblages were compared to inferred structure construction dates derived from tree-rings, Sorrell found a strong positive correlation between the two variables (Sorrell 2005:90-92). After subjecting this dataset to a battery of statistical analyses, he concluded that San Francisco Mountain Gray Ware sherds did in fact increase in thickness over time and those changes were highly predictable and easily modeled.

Sorrell produced a linear regression equation: $y = (241.84)x – 179.05$, and a quadratic regression equation: $y = (-136.81)x2 + (1600.09)(x) – 3528.90$ (where 'y' equals estimated feature construction date and 'x' equals mean sherd thickness), to model mean sherd thickness change. He used those models to create a set of predicted dates for the sites included in his study as well as another set of predicted dates for the same set of sites using WMCD in order to compare their accuracies. His quadratic model predicted site construction dates slightly more accurately than his linear model, the former of which produced an average absolute residual between actual and predicted construction date of 34 years and a standard deviation of 42 years (Sorrell 2005:103). WMCD on the other hand produced an average absolute residual of 41 years and a standard deviation of 55 years (Sorrell 2005:99). Thus, for the first time in Southwestern archaeology, Sorrell created a chronometric method using plain ware ceramics that is more accurate than methods relying on the best dated decorated prehistoric ceramic types in the world. Furthermore, Sorrell's Mean Sherd Thickness Dating for San Francisco Mountain Gray Ware is the first fine grained chronometric tool available to Cohonina researchers (tree-ring dating notwithstanding) and effectively solves all of the problems Cartledge identified with the method of ceramic cross dating using Kayenta types.

Despite MSTD's apparent accuracy and ease of use, it has gained only limited acceptance in Cohonina archaeology with its use being concentrated almost exclusively amongst Kaibab National Forest archaeologists. This situation is likely attributable to three factors:

theory supporting the technique is underdeveloped, there are gaps in Sorrell's original data, and the sheer force of habit among archaeologists in the selection of chronometric techniques in the Northern Southwest. The first point is particularly problematic because in the absence of a strong theoretical base, misapplication and/or misinterpretation of chronometric methods become a real problem (Ahlstrom 2008). When Sorrell completed his study of San Francisco Mountain Gray Ware sherd thickness, he provided only short discussions as to why Cohonina vessel walls, and by extension sherds, increased in thickness over time and how a chronometric technique based on that change ought to be used by researchers.

Sorrell (2005:60) citing Rice (1987) argued that vessel wall thicknesses for utilitarian wares might increase over time as an adaptive response to changing demands put upon those vessels. In the case of San Francisco Mountain Gray Ware Sorrell postulated that as Cohonina economic production increasingly focused on agriculture and its suite of sedentary behaviors, the need for greater storage volume increased in lock-step. Since ceramic jars presented the best storage technology over say subterranean cysts or baskets in terms of resistance to rot and pests, they became the focus of innovation that supported the production of increasingly larger jar sizes.

The relationship between wall thickness and vessel size is twofold, having to do with a vessel's "green" and "fired" states. Sorrell emphasized the physical stresses of the green state in which a potter aiming to produce large vessels must increase vessel wall thicknesses, add more tempering material, or both in order to prevent slumping or distortion during the green phase of construction. The green phase refers to the period when the clay body of the vessel is in a weak unfired state, but must be able to adequately support the vessel superstructure which might include rim architecture, handles, and the like until it is fired. However, physical stresses unique to the fired stage (also the functional use stage) of a large storage vessel also favor greater wall thicknesses. These factors include the need for large storage jars to withstand kinetic shocks without cracking, resist thermal conductance, and finally resist prolonged periods of abrasion in the areas where they contact the ground, vessel supports, or other storage jars. All of these functional demands would be in play regardless of what product one was storing be it maize, piñon nuts, or potable water, all of which are supported by the archaeological record (Colton 1946; Hargrave 1933; Hargrave 1938; Janetski 1999; McGregor 1951; Sullivan 1992).

That San Francisco Mountain Gray Ware jars increased in size over time is assumed rather than investigated in Sorrell's study, which is perhaps excusable given that his efforts were focused on demonstrating the operation of a technological trend and its manifestation in the archaeological record (as ceramic sherds) rather than explaining it. However, it would be eminently advisable to demonstrate that the theorized mechanisms of change were actually in play. To the author's knowledge only one applicable study has been carried out for San Francisco Mountain Gray Ware, that being Mills' (1993:336-346) examination of jar aperture width change in Patayan ceramics. That study found that aperture diameter increased over time for Patayan jars which she defined as including San Francisco Mountain Gray Ware and Prescott Gray Ware. Mills argued that jar aperture diameter inferred by measuring rim sherd arcs was a reasonable proxy for relative jar size assuming the two measures are positively linked. Thus, since Patayan jar aperture diameters increased over time then presumably total jar size increased over time as well. While this study supports Sorrell's model of San Francisco Mountain Gray Ware change, it does have problems. First, Mills reduced the interpretive clarity of the results by combining San Francisco Mountain Gray Ware and Prescott Gray Ware under one analytical category. It is altogether unknown whether or not the same processes were in play among these two geographically well separated wares. Second, assuming that jar aperture diameter and overall jar size are positively linked and the former can be used as a proxy measure for the latter introduces a weakness to the study because the physics of ceramic vessel construction do not demand that this invariably be so. All things considered, we can take the Mills' study as cautious support of Sorrell's model of San Francisco Mountain Gray Ware change.

Throughout Sorrell's model of San Francisco Mountain Gray Ware change are appeals to adaptive forces bringing about change in the technological base of the Cohonina. Given this situation, it is curious that Sorrell does not engage "Darwinian" or "Selectionist" theory to examine those forces, even though that considerable body of literature would lend broad theoretical support to his study. Selectionist archaeology uses biological evolutionary theory to examine cultural as well as biological variability (Trigger 2006:429). Explaining change in material culture or what selectionists call the "extended phenotype" of human beings is a strong suit for this approach and involves identifying specific aspects of material culture that change over time and then isolating the causes of those changes in the larger cultural and/or ecological system.

O'Brien and colleagues (1994) conducted an analysis of Midwestern Woodland and Mississippian ceramic technologies using selectionist theory. Changes in cooking vessel mean sherd thickness is one attribute amongst many they tracked over time and then attempted to characterize selective forces acting on that attribute. In the wares they examined, mean sherd thickness decreased over time. Drawing on experimental data that tested the relationship between wall thickness, thermal conductivity, and resistance to thermal shock, they argued convincingly that the reduction in cooking vessel wall thickness over time was attributable to strong adaptive forces selecting for cooking vessels that had strong resistance to thermal shock and high thermal conductive properties. These selective forces, they argued, were ultimately attributable to a Late Woodland dietary shift to oily and starchy seed crops that require extended cooking times to maximize nutrient extraction and palatability. While the change observed in San Francisco Mountain Gray Ware mean sherd thickness is the opposite of that reported in the O'Brien et al. (1994:282) study, it does not mean the selectionist approach is not applicable here or that Sorrell's findings are unacceptable. On the contrary, it appears very different selective forces were at work in the Midwest than on the Coconino Plateau. In the Midwest change in ceramic ware attributes appears linked to vessels supporting a cooking function whereas change on the Coconino Plateau appears linked to vessels supporting a storage function. Sorrell (2005:143) lamented that his study might be an atavism, a harkening back to the "bad-old days" of culture-historical archaeology. However, it appears that concern is unwarranted because his study provided a much need chronometric tool as well as standing on the threshold of the very much contemporary field of Selectionist archaeology, a school of thought that relies extensively on culture-historical analysis and is well adapted to describing and explaining specific instances of cultural change in the archaeological record.

Turning our attention to the application of MSTD, Sorrell (2005:105-106) designed the technique to be applied in a pedestrian survey context where time is of the essence and cost per datum collected for any archaeological phenomenon must, in most cases, be kept to a minimum. In that respect Sorrell succeeded tremendously in that collection and processing time takes around one hour per dated feature. The surveyor flags the requisite number San Francisco Mountain Gray Ware sherds at a site and then records no less than four thickness measurements per sherd. The surveyor must record no fewer than 23 sherds to achieve the confidence level and 1-sigma error described earlier [Sorrell 2005:104-105] and those sherds must originate from the body of the vessel, not its rim. These data are then typically entered into Microsoft Excel where they are applied to the regression model of choice. The first iteration of establishing dated and reference events in MSTD are the same as any chronometric method based on tree-ring dated ceramics, that is the growth of the outer ring of wood specimens, ideally "cutting dates", and ceramic production. The target event in MSTD is the construction of individual features within a specific site.

Sorrell successfully identified and explained bridging events that allow the dating of individual San Francisco Mountain Gray Ware assemblages with wood specimens, but left a number of bridging events unexamined that allow the dating of individual features with San Francisco Mountain Gray Ware sherds. In MSTD the production interval of San Francisco Mountain Gray Ware is not desired (the second iteration of establishing a reference event), instead the production of individual vessels becomes the intended reference event. This kind of event occurs over a matter of days or weeks, not years, which introduces some special considerations in arriving at the intended target event. For example, say a structure was built in A.D. 1050. In A.D. 1101 new storage jars produced in A.D. 1100 were brought in to replace the structure's original stock before the entire assemblage was abandoned. In this scenario fifty years worth of vessel thickness change goes unaccounted for, potentially skewing the results of the MSTD technique.

In fact this scenario seems to have played out at one site included in the current study: the Pittsberg Fort Complex (Site 03070100889, NA3577). Sorrell (2005:75) included thickness data from sherds collected from structure A and the surface of the site. Dendrochronological data (Ahlstrom 1983) indicate Structure A was built in A.D. 1053, repaired in A.D. 1065, and burned some time after A.D. 1065. If we assume Kayenta trade did not break down, then the lack of Flagstaff Black-on-white and Citadel Polychrome at Site 00889 would indicate the site burned and was abandoned sometime prior to A.D. 1150. Thus Structure A could have been in use for seventy-five years before it went up in flames, meaning that at least some portion of its storage vessel stock must have been replaced during that interval. The major implication of all this being that those younger and presumably thicker jars produced sherds that eventually skewed the MSTD estimate of A.D. 1113 (Sorrell 2005:102) because they are not directly associated with the *construction* of Structure A. This in turn begs the question of what target event MSTD should actually aim for: the construction of a feature or its final use.

Sorrell identified another methodological problem associated with MSTD having to do with its application to multi-component sites. He pointed out that applying chronometric methods based on means of temporally sensitive attributes to assemblages from sites with widely separated temporal components should, as a rule, not be done (Sorrell 2005:106). Although he does not explicitly state why, besides means being susceptible to extreme values, I believe Sorrell's prohibition refers to the methodological problems of "time averaged deposits" (Bailey 2008; Sullivan 2008), of which surface ceramic assemblages most definitely are. In that situation, distinct temporal components at a site, represented as extremes or multiple modes in the distribution of mean thicknesses, might produce an erroneous date estimate. On the other hand, Sorrell points out that multiple components might be identified by looking for multimodal thickness distributions.

A final challenge to the successful application of MSTD and one not addressed by Sorrell has to do with its application to surface assemblages and the potential negative effects of non-storage vessels or a single storage vessel contributing to the measured sample of San Francisco

Mountain Gray Ware sherds. The application of MSTD was designed with pedestrian survey in mind, but Sorrell does not address problems associated with taking surface assemblages as representative of a buried feature or of a site as a whole. For example, the surface assemblage sampled at a site would represent the latest episode of occupation if significant soil aggregation was in play and stratigraphic superposition remained intact. In that case, dating the formation of the final sherd assemblage is a more viable target event than initial site formation, especially if the two events are widely separated in time. However, if significant time averaging through surface deflation or lack of soil aggregation occurred (this is the case in many parts of the Northern Southwest) then the intended target event of MSTD becomes more difficult to date confidently as the method might succumb to confounding effects similar to those found at multicomponent sites. Of course, if the sites or features within sites formed over relatively short periods, say less than forty years, then these considerations are not as critical.

Finally, there is no way of knowing at this point what the inclusion of sherds originating from non-storage vessels or sherds originating from a single storage vessel has on MSTD. Presumably, different selective pressures were acting on non-storage vessels such as serving bowls and cooking pots, than on large storage vessels, meaning mean thickness change over time might be different for those functional classes. It seems the method is intended to use average sherd thickness sampled from an entire assemblage (Sorrell 2005:63) which might mean MSTD is not significantly affected by non-storage vessel sherds, but this is assumed rather than demonstrated. However, it is lucky that most non-storage vessels in the San Francisco Mountain Gray Ware series are painted bowls, small jars, and pitchers, which in sherd form are easily differentiated from large jar sherds. However, the author suspects some portion of large Cohonina jars were used for cooking, not storage. Unfortunately, this sort of functional variation has not been studied in the San Francisco Mountain Gray Ware series. However, if neighboring wares are any indication, the divide between storage and cooking might not have been absolute (Mills 1993:301-306), suggesting much remains to be clarified on this front. Finally, dating a site based on sherds originating from a single storage vessel may or may not produce erroneous date estimates. However, this situation is likely only to occur at sites occupied very briefly, a gathering camp where a single jar was broken for example. This would mean the MSTD estimate would closely estimate site occupation assuming the interval between vessel construction and vessel destruction at the camp was short.

Turning our attention to the gaps evident in Sorrell's (2005:88-89) original data we find that sites dating prior to about A.D. 1000 and very late sites (post A.D. 1125) are underrepresented. Sorrell was aware of these and other limitations in his study and admonished the reader to be cautious in their application of MSTD until a greater number of tree-ring dated sites were used to improve and further test his model (Sorrell 2005:143). The method has been applied to several hundred surface assemblages in a survey context and those results indicate the method is viable in that date estimates generally fall within date ranges produced by Ceramic Cross Dating (Weintraub 2011, personal communication). However MSTD tends to estimate site formation towards the later end of ceramic cross dating estimates or those produced by ceramic groups. The reasons for this are, as yet, unresolved.

In 2007, McCormick attempted to refine MSTD by including sherd thicknesses from two tree-ring dated contexts located in the Upper Basin of the Coconino Plateau. However, the sites she used dated to between A.D. 1050 and 1070, precisely the period with the most data coverage in Sorrell's original study. Thus her efforts did little, if anything, to refine MSTD other than finding greater support for Sorrell's quadratic regression model over his linear model. She admitted to this situation in the context of acknowledging that she ought to have sought out very early or very late tree-ring dated Cohonina sites for analysis (McCormick 2007:28). With regards to tradition in selecting chronometric techniques by Northern Arizona archaeologists, the current isolated use of MSTD is likely to continue until the theoretical and methodological challenges associated with the technique are resolved and the method is published in a major peer reviewed journal. In the context of the current study I make use of MSTD to date sites within the project area alongside ceramic cross dates.

A New Cohonina Chronology

Cartledge rejected all previous Cohonina chronologies in his 1986 synthesis. His proposal for a new chronology assessed tree-ring data reviewed by Ahlstrom (1983) and then current ceramic production dates underpinning ceramic cross dating to arrive at Cohonina period designations lacking spatial/cultural connotations. He rejected Colton's foci for the same reasons I have (Chapter 3), but also rejected the use of Willey and Phillips' (1958) phases because the various Cohonina chronologies proposed to that point identified phases/foci almost exclusively on ceramics alone and not on an inclusive suite of cultural traits.

McGregor excavated a shallow pit house near Red Butte that produced the earliest known tree-ring date from a Cohonina context. Ahlstrom's (1983:12) reassessment of the early McGregor date places it at A.D. 775, which Cartledge used to argue for a Cohonina chronology beginning no earlier than A.D. 700. This argument, by implication, rejected Schwartz's (1955) earlier Hermit phase. Cartledge acknowledged the presence of Lino Gray and Lino Black-on-grey at Cohonina sites, but argued their production start dates in the mid A.D. 500s does not definitively support a pre-700s Cohonina presence, especially when production for those types ended in the mid-850s and they are often in association with later Kayenta types. Ahlstrom (1983:21) points to a unit structure near Red Lake as the latest tree-ring dated Cohonina context at A.D. 1128. Cartledge used this date to support the established A.D. 1150 end for the Cohonina Chronology. After assessing the available data and rejecting McGregor's (1951) and Schwartz's (1955) chronologies, Cartledge supported Colton's (1946) chronology, but argued period designations should be used instead of foci or phases.

Schubert (2008:33) reassessed the Cohonina chronology in response to a need to gain strong chronological control over the KNF archaeological database. In order to gain that control he reassessed the original set of fifty-two single component Cohonina sites Colton (1946) used to build his Cohonina chronology. By engaging in that analysis he intended to arrive at an updated chronology and set of ceramic groups that could be applied to the KNF archaeological database

(Schubert 2008:51-52). Schubert argued that by applying WMCD, which incorporates current understandings of Northern Arizona dendrochronological data (Robison et al. 1975; Downum 1988, 2003; Garcia 2004), to the ceramic assemblages presented by Colton, he could simultaneously update the Cohonina chronology and create Cohonina specific ceramic groups. Schubert's Cohonina chronology is the most comprehensive effort to date and is presented alongside those previously discussed (Figure 4.1).

Schubert found that Colton consistently placed Cohonina sites within phases that he associated with subsets of his eight ceramic groups. For example, sites assigned to Ceramic Groups 7 and 8 were always assigned to the Hull phase. When Schubert applied WMCD to forty-two of the fifty-two Colton sites for which sufficient data existed, he found that those sites assigned to specific phases still clustered together but with consistently later dates. As a result Schubert proposed new date ranges for Colton's phases that accommodated the WMCD dates and are bracketed by the phase-in or phase-out for specific Kayenta Anasazi ceramic types that Colton originally used to create his phases.

Schubert (2008:54) supported Sorrell's (2005:127) earlier resurrection of Schwartz's (1955) rarely mentioned Hermit phase, dating it from A.D. 550 to 800 based on the earliest phase-in dates of Lino Black-on-grey (A.D. 550) and Kana-a Black-on-white (A.D. 800). Schubert's Hermit phase is more inclusive than Sorrell's (A.D. 750 to 850) and by extension acknowledges the possibility of very early Cohonina sites which are supported by another study examining pre-ceramic settlement patterns (Lyndon 2005:145-151). The convergence of evidence produced by these three researchers indicate the Hermit phase is a viable concept and that Schubert's early A.D. 550 date is justified given the undeniable and perennial presence of people on the Coconino Plateau during Basketmaker III times and that those folk eventually developed the cultural tradition known as Cohonina.

Schubert found that Colton's Coconino phase sites' Weighted Mean Ceramic dates clustered between A.D. 910 and 1010. Since this date range correlated with the currently understood

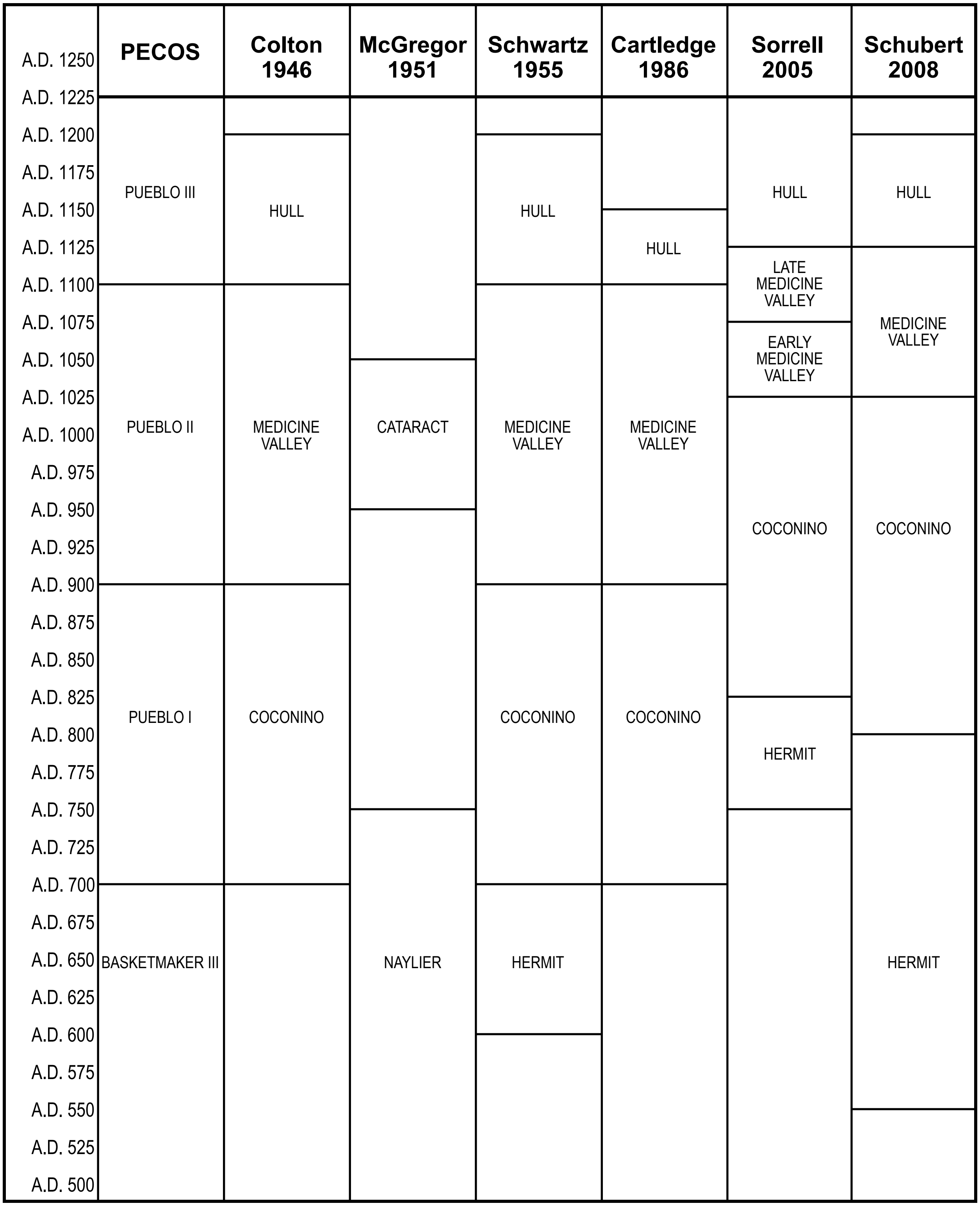

Figure 1. Proposed Cohonina chronologies.

transition date of A.D. 1025 between Kana-a Black-on-white (phase-out) and Black Mesa Black-on-white (phase-in), he suggested the Coconino phase be changed from A.D. 700 to 900, to A.D. 800 to 1025. During the Coconino Phase populations remained low across the region, but steady growth characterizes this phase (Samples 1992:108-109). Populations also moved down slope out of the ponderosa forests and into the piñon-juniper woodland (Schubert 2008:147).

Schubert placed the Medicine Valley phase between A.D. 1025 to 1125. During this phase population growth increased dramatically and Cohonina populations reached their greatest spatial extent as they spread out across the plateau (Schubert 2008:149), coinciding with "one of the best documented periods of increased effective moisture on the Colorado Plateaus" (Euler et al. 1979:1096). This pattern is evident in the Sitgreaves Community data where site counts and density increased dramatically during that period, suggesting that a process of population aggregation was in play. In the late 1000s social and environmental events may have triggered major upheavals in the Cohonina region. By A.D. 1080 the Hohokam ballcourt network was beginning to fall apart coinciding with major socio-political changes in the Hohokam core area. This process may have triggered social reorganization along the southern edge of the Coconino Plateau where the greatest concentration of ballcourts depopulated no later than A.D. 1075 (Weintraub et al. 2006:11, 14), generally coinciding with the breakdown in southerly trade in Coconino Plateau obsidians (Shackley 2005). Between A.D. 1085 and 1090 a catastrophic volcanic eruption visible from as far away as 400km formed Sunset and Gyp Craters, three associated lava flows and deposited cinders over a 2,300km^2 area, 300km^2 of which saw total destruction (Elson 2011:128, 197). Wild fires in surrounding forests would have undoubtedly expanded the area of destruction. Elson (2011:204) very conservatively estimates the Sunset Crater eruption created between one and two thousand Sinagua volcano refugees whom they argue moved north and south of the destruction. However this major demographic event likely ramified west as well, towards the Cohonina core 50km away.

Schubert placed the Hull phase at A.D. 1125 to 1200. He based his Medicine Valley to Hull boundary on Colton's consistent break between his Medicine Valley phase sites and later

Hull sites which fell at A.D. 1125. Schubert ended the Hull phase at A.D. 1200 because no sites with San Francisco Mountain Gray Ware have been identified after that date. Tree-ring evidence (Ahlstrom 1983), work in the Upper Basin (Sullivan 1986), and east of San Francisco Mountain (Stone and Downum 1999; Elson 2011) indicate San Francisco Mountain Gray Ware production and by extension the Cohonina extended at least until A.D. 1150. Garcia (2004:264-266) found that during the Hull phase the incidence of San Francisco Mountain Gray Ware on the Coconino Plateau declined precipitously while the geographic extent of Tusayan Gray Ware expanded. He argued that the two distributions were linked and the patterning evident in the former represents the dissolution of the Cohonina as subsets of that population assimilated with neighboring Kayenta and Sinagua populations in response to intensifying competition in the post-Sunset Crater eruptive years and later increasing environmental instability in the period between A.D. 1130 and 1180 (Garcia 2004:261-267, 275-280).

Landscape Archaeology and Settlements Systems Analysis

The intellectual pedigree of landscape archaeology is traceable to the 1970s in the beginnings of the critique of processual archaeology. Like so many of the dualities imposed on intellectual endeavors of the time, landscape archaeology is deeply intertwined with a perceived opposite: settlement archaeology. Whereas settlement archaeology is concerned with the ecological, political, economic, and social of past human-environment interaction, (so it goes) landscape archaeology is concerned with the culturally mediated, ritualized, phenomenological, and symbolic experience of past human-environment relationships. Trigger (2006:473) regarded landscape archaeology as a culturally oriented counterpart to settlement archaeology and traced it to Hodder's (1984) exploration of prehistoric symbolism fixed in relationships between European houses, tombs, and their geographical settings. On the other hand, Sherratt (1996) also perceives the approaches as complementary, but traces an older philosophical history between the two going back to the Enlightenment in the case of settlement archaeology and the rise of Romanticism in the case of landscape archaeology.

Despite some alleged antagonism between settlement and landscape archaeology (Witcher 1999), both Trigger and Sherratt hit at the crux of this issue in that both approaches are actually an intertwined bifurcation of the same intellectual endeavor. Landscape archaeology and its settlement counterpart both seek to use the human modified and experienced environment as a strategic starting point to examine the past. Landscape archaeologists use many of the same methods of data production as settlement archaeologists, such as regional survey and GIS, but differ from their settlement colleagues in the formulation of the questions they are asking and theoretical pedigree they claim. The questions that landscape archaeologists ask about the natural and built environment revolve around its perception, symbolic meaning, and the recursive relationship between social structure, landscape, and agency. This leads them into encounters with structuration theory, and the concepts of praxis and habitus which all seek to understand how culturally embedded self-interest acted out in the material world shapes and is shaped by social structure. These problem domains, like most social science practice, ultimately lead back to Marxian theory (Wolf 1982:xi, 20; Hegmon 2003:219) and thus find much agreement with settlement archaeology.

An early example comes from Tilley's (1984) investigation of social structure and the manipulation of ideology during the Neolithic in Southern Scandinavia. In that study Tilley uses Marxian theory concerned with ideology and settlement systems data to understand the relationships between settlement, public architecture (tombs), and the environment. Tilley argues that settlement data reflect more than economic forces influencing human behavior and suggests the morphology and location of tombs was predicated on a symbolic system that actively engaged the landscape. One aspect of his study investigated the interrelationships between megalithic tombs and their overall relationship to the surrounding landscape. Tilley found that the axis orientation of these tombs mirrored the lay of their surrounding landscape. He interpreted this relationship as reflecting a process in which the tomb builders made an arbitrary social order, symbolically embodied in tombs, appear as natural and immutable by mirroring the natural landscape (Tilley 1984:139). The major implication of this study is that meaning, the socially active and structuring nature of the landscape and the build environment, and ideology are all accessible features of the archaeological record.

Fowles (2010) has argued for the existence of a unique Southwestern school of landscape archeology. The practitioners of this school are characterized by their engagement with native philosophical traditions which they see as unique epistemologies capable of producing new testable hypotheses (Fowles 2010:454). For example, Bernardini (2005) has investigated the serial migrations of the Hopi codified in their oral traditions to help understand how meaning and identity become linked to ancestral places. The second defining aspect of the Southwestern school is its adherence to a strongly realist and empiricist stance in which behavioral approaches like settlement archaeology are still viewed as critical. This closely parallels European landscape traditions, but there is a more explicit hesitancy to engage in phenomenology and a more rigorous attempt to weld the behavioral goals of settlement archaeology to the humanistic ones of a landscape perspective (Fowles 2010:464). Taken together, Southwesternists are increasingly aware that questions of agency, meaning, religion, ideology, and place are as important as supposedly normative processual studies (Hegmon 2003). These interests are driving investigations of the Southwestern landscape which seek to rigorously "understand the way in which they were perceived and experienced on the ground by culturally situated individuals" (Fowles 2010:459).

Landscape Archaeology, Visibility Analysis, and Geographic Information Systems

In the context of this thesis, the theoretical and methodological advances packaged in landscape archaeology provide a solid starting point from which to explore the symbolic meaning of the visual landscape. The proceeding discussion demonstrates it is possible to access past symbolic systems through the medium of material culture. I noted in Chapter 3 that several researchers had suggested that Cohonina forts were connected by lines-of-sight for the purposes of communication, but no serious effort has ever been made to test that hypothesis. Anthropological literature of the Southwest is replete with examples of line-of-sight communication networks. Ethnographic accounts of the Yavapai dating to the 1860s in what is now Central Arizona describe a line-of-sight communication network utilizing smoke and fire. One example describes how accurate information coded in white and black smoke columns emanating from elevated positions was conveyed over 300 miles (Wilcox et al. 2000:120). An ethnohistoric account of line-of-sight communication networks comes from the Coronado entrada. When Coronado's vanguard struck the Little Colorado River at the edge of Shíwana (Zuni) in July of 1540, their presence was already known well in advance. A day after they reached the Little Colorado River, vanguard members of the column saw plumes of smoke to the sides of their route which they rightly interpreted as line-of-sight signals to the Shíwana pueblo of Hawikku (Flint 2008:103).

Archaeologists have also made arguments for the existence of line-of-sight communication networks dating from the late Prehistoric through the Protohistoric period in the Chaco, Kayenta, Cerbat, Hohokam, Sonora, Casas Grandes, and Gallina regions of the Southwest (Wilcox et al. 2000; Swanson 2003:754). All of these proposed networks consisted of line-of-sight linkages between topographically elevated features. These features are sometimes little more than cairns, but also include entire pueblos and at least one instance where an intervening topographic feature was removed to create the line-of-sight (Haas and Creamer 1993:30). Given the near ubiquitous existence and great time depth of line-of-sight communication networks from all parts of the Southwest, it is reasonable to suggest as Cartledge (1986), Remley (1989), and Hanson (1999) have that the Cohonina engaged in similar behavior. It would perhaps be more surprising if no evidence was found for such behavior. One aspect of this thesis seeks to rigorously investigate this hypothesis with the aid of GIS and hence must draw on theory derived from landscape archaeology and the methods associated with GIS based visibility analysis.

Theory and Visibility Analysis

Visibility analysis in archaeology consists of techniques that calculate intervisibility between points on the landscape. The significance of visibility in the archaeological study of the human built environment goes back to the Eighteenth century in Europe and at least the 1970s in the Southwest, but this avenue of study has only recently gained in popularity since the advent of GIS analysis in archaeology (Van Leusen 2002:6.9; Swanson 2003:754). Before GIS based tools became available, visibility analysis consisted of time and labor intensive manual cartography coupled with field observations (see Wilcox et al. 2000 and Haas and Creamer 1993 for examples). GIS based tools such as viewshed analysis and line-of-sight analysis (LOSA) allow archaeologists to quickly generate and test hypotheses concerned with the visible or non-visible aspects of the landscape, which includes both natural and human made features. This sort of GIS based visibility analysis focused on accessing the subjective experience of past peoples and what they perceived as important is a popular approach within landscape studies (Gaffney et al. 1996; Maschner 1996b; Van Leusen 2002). The importance of these efforts lies in their desire to model what could have been perceived by some individual positioned in a past landscape, and then proceeding to identify what cognitive aspects of that landscape were significant. Thus visibility analysis seeks to examine the link between visibility and cognition (Van Leusen 2002:6.12) wherein lines-of-sight and viewsheds become spatial indices of perception, or the part of the landscape, be it natural or human wrought, that may have communicated visual information in the past (Gaffney et al. 1996:146).

Visibility analysis in GIS is based on algorithms that automatically determine whether or not any given pair of points are intervisible. This process requires a topographic model, normally a raster image containing x,y, and z spatial data known as a Digital Elevation Model (DEM) and points between which to calculate a line-of-site. A line-of-sight in GIS is calculated by creating a line between the observer and target points, incorporating the height of the observer and target above the DEM (known as "offsets"), their position on the DEM, the intervening terrain along the line, and the curvature of the Earth. If the intervening DEM cells fall below the line-of-sight, then the target and observer points are intervisible. On the other hand, if an intervening cell or cells are blocking the line-of-sight by being above it, then the target and observer are not intervisible.

Visibility analysis in GIS can go beyond calculating single lines-of-sight by creating a viewshed. A viewshed represents all points on the DEM that can be seen from the observer point. Viewsheds are essentially the *n* set of line-of-sight calculations to determine visibility from the observer point to every cell within the DEM. These calculations are usually displayed as binary coded raster maps indicating which cells are visible and which are not. The simplest result of a viewshed analysis is the single viewshed which codes information from a single observer point. A multiple viewshed merges a set of single viewsheds, coding each cell in the DEM as either visible or not visible. Cumulative viewsheds are the algebraic sum of two or more single viewsheds in which each single DEM cell is coded as non-visible or visible to one or more observer points. Finally, a total viewshed calculates all possible lines-of-sight from each cell in the DEM and codes the results as the number of target cells that are visible from each cell.

Results from LOSA and the various types of viewshed analyses act as models of perception for archaeologists attempting to ask questions about the visibility of past landscapes. Early British attempts to move away from the alleged ecological determinisms of GIS based processual studies and towards modeling past perceptions of the landscape relied heavily on visibility analysis (Van Leusen 2002:6.2). For example, Lock and Harris (1996) used GIS based viewshed analysis to investigate change in the cognitive landscape from the Neolithic to the Late Iron Age around Danebury, England. They examined viewshed intersections between monuments to document changing perceptions of what was deemed significant on the landscape. On the one hand, they found Neolithic long barrows were intentionally positioned on the landscape to prevent intervisibility between them (Lock and Harris 1996:224), while on the other hand Late Iron Age hillforts were positioned on the same landscape to maximize their visual dominance over the surrounding landscape (Lock and Harris 1996:232).

Schubert (2008) conducted the only visibility analysis in the Cohonina region to date. He wanted to explore whether or not the Cohonina intentionally positioned their communal gathering places (i.e. “sites”) to maintain views of the largest mountaintops on the Coconino Plateau (Schubert 2008:136). Schubert wanted to use visibility analysis in an attempt to access meaning in the Cohonina archaeological record. Specifically, he wanted to determine whether or not habitation sites were positioned to allow views of certain mountains more than others, and if so, he wanted to know if these relationships changed over time. He generated a cumulative viewshed for all known habitation sites separated by phase and then examined how many of those viewsheds intersected cells representing five major mountain tops. He found that appreciable numbers of habitation sites can see mountaintops and those numbers changed over time. However, he made no attempt to test the significance of those results, nor did he attempt to banish equifinality by refuting equally plausible hypotheses that could account for the patterning. i.e. happenstance, result of economically or ecologically triggered settlement shifts, etc. Thus he was unable to access meaning coded in the Cohonina archaeological record.

The Practice of Visibility Analysis

Visibility analysis, like any analytical method, is vulnerable to misapplication and misinterpretation. These vulnerabilities generally fall within three related themes, all of which can mislead the GIS user to erroneous inferences. These include computational challenges, experiment design, and significance testing. The first theme has to do with computational differences between GIS platforms or specific analyses performed by archaeologists. All of the various GIS platforms available use slightly different algorithms to compute LOS and viewsheds, which can result in different results from the same data (Conolly and Lake 2006:228). Secondly, most GIS platforms allow the user to alter the parameters of LOS and viewshed analyses. For example, ArcGIS 10 allows the user the option to account for the curvature of the Earth, define offsets, azimuths, vertical angles, and maximum radius of the analysis. While it is typical to allow for the curvature of the Earth, manipulation of the other parameters is dependent on the user’s research goals. These computational challenges only become a problem if the user does not account for them, or is not explicit in their research design.

The second theme has to do with experiment design. Some of these variables are open to manipulation by the user and some are not. For example, the problem of reciprocity describes situations where the target point is visible to the observer point, but not the other way around (Conolly and Lake 2006:229). When there is great disparity between the target and observer offsets, there is a high likelihood that visibility is not reciprocal. Therefore, viewsheds should only be interpreted as modeling what the observer can see without assuming reciprocity. Accounting for this issue should occur within a problem oriented research design and not as an ad hoc "fix" to LOS or viewshed results.

DEM resolution is another challenge that must be accounted for. Archaeologists conducting visibility analysis realized early on that the resolution of their DEM could seriously impact the results of their analyses (Madry and Rakos 1996). DEMs code one averaged elevation datum per rectangular cell (usually square) of a specified area and these cell areas can vary considerably. Some DEMs contain quite dense elevation data with cell areas of less than one square meter, while others might have relatively low resolutions on the order of 900 square meters.
In the last decade a consensus as to what DEM resolution is suitable for visibility analysis has coalesced after much hand wringing, with most feeling the higher the resolution the better. The impact on research design is very basic: archaeologists must seriously consider whether the DEM resolution available is fine enough to adequately model the landscape they are investigating. For example, if the scale of analysis is relatively local such as a single landscape feature and the DEM is low resolution, then the results will likely be suspect. If the analysis is regional in scale such as a physiographic region and the DEM is low resolution, then the results will be on a stronger footing.

Substantive challenges describe the determining factors that lead to parameter values and data used for visibility analysis (Conolly and Lake 2006:230). The first has to do with how accurately a DEM models a past landscape. If substantial geomorphological change has not occurred and time depth is not great, then modeling a past landscape is not a major challenge. However, if major geomorphological changes have occurred such as urbanization, river meandering and the like, then the use of DEMs derived from the modern landscape to model that of the past becomes suspect. A related substantive challenge is the so-called "tree factor" which describes the impact vegetation has on visibility. DEMs typically model landscapes as "bare earth", or devoid of vegetation. If it can be demonstrated that vegetation was low in the past and thus did not significantly impact visibility, then the tree factor is not a major challenge. However, if vegetation was high, dense or changed significantly with the seasons, then bare-earth DEMs may not model the past landscape with enough fidelity to allow visibility analysis.

A second set of substantive challenges have to do with modeling the observer. First the height of the observer must be accounted for with offsets. This might involve estimating the average eye level of the resident population, but might also include the height of a built structure if one was involved at the observer point. Both estimates might pose considerable challenges if biological data is lacking or if architectural reconstructions are required. The acuity of vision of the observer is a bigger challenge and refers to how far an observer can reasonably see, or make out low contrast landscape features in the distance. The biological abilities of the observer play a major part in this, but variable atmospheric conditions also affect how far a person can see and in how much detail. This is typically addressed by limiting the radius of the viewshed based on real-world visibility observations within the region, but this does not model the gradual reduction of vision as distance from the observer increases. "Fuzzy viewsheds" have been proposed as a solution to this problem (Maschner 1996:9b; Van Leusen 2002:6.11).

Contrast of the target landscape features may also have a significant impact on viewshed analysis. Low contrast between a large natural feature and its surroundings might not lower its overall visibility, but the same situation might render a relatively small human wrought feature indistinguishable from its background. An observer might know precisely where on the landscape their intended visual target is, but might still be unable to see it. In this case highly visible options such as reflective materials, smoke, and fire could be used. In the Southwest, line-of-sight communication networks often involved smoke and fires which dramatically increases the discernibility of a visual target, especially at night in the latter instance. Swanson (2003:756) reports the maximum visibility of fire signals at 72 km. Smoke signals might be seen from a great distance because the ensuing smoke column might rise to several hundred meters before dissipating (Wilcox et al. 2000:120). However, seeing the point of origin of the smoke column might be the important factor, in which case intervening topography might be the major limiting factor.

Significance testing is the last and arguably the most challenging theme in visibility analysis. Early on in the archaeological use of visibility analysis, researchers simply reported the properties of lines-of-sight networks or viewsheds. This usually took the form of simply stating that intervisibility existed between some observer point and an archaeological feature the researcher deemed visually significant. For example Gaffney and colleagues (1996) argue a significant visible relationship existed between a set of mounds on the island of Hvar. A viewshed produced from one cairn does show all of the other mounds are visible from that observation point, but no effort was made to determine if this relationship is coincidental or the result of intention on the part of the mound builders. The archaeological relevance of LOSA and viewshed analysis depends upon demonstrating that the visibility characteristics of the archaeological phenomena under investigation are significantly different from the background visibility values of the landscape in which it is positioned (Van Leusen 2002:6.11).

There is anxiety in some circles, not without reason, that work in landscape archaeology and by extension cognitive archaeology is succumbing to the postprocessual temptation to throw technical rigour out the window (Flannery and Marcus 1996; Van Leusen 2002:6.14; Trigger 2006:473). Within the realm of visibility analysis, testing intentionality lies at the heart of maintaining methodological control and hence archaeological relevance. In the absence of such controls LOSA and viewshed analysis becomes a frighteningly easy tool to impose one's own cognitive significance onto landscape features.

There are two levels to significance testing models of visual communication networks preceding the step of interpretation. Establishing the existence of lines-of-sight between features is the first and easiest step in that process, although it is fraught with pragmatic and procedural challenges. Demonstrating that those lines-of-sight and hence the proposed network models past reality is the second level of significance. This challenge is best described as a task in differentiating between coincidence and intentional, purposeful human action. This is sometimes a straight forward procedure when the intervening landscape was explicitly modified to create a line-of-sight (Hass and Creamer 1993:30). However, most other cases require more rigorous validation.

Combining GIS methods such as LOSA and cost surface analysis (Madry and Rakos 1996) have been used to demonstrate intentionality in the existence of line-of-sight connections between archaeological features. Van Leusen (2002:6.15) argues that statistical tests which evaluate differences between hypothesized visual correlations and randomly sampled correlations as a sound approach. In that same vein, Swanson (2003) used LOSA to define a hilltop communication network surrounding Paquime in Northern Mexico. He then created LOS networks for randomly selected hilltops in the same region and compared those results to examine the chances that the completely integrated and highly redundant network defined by hilltop features could have occurred by chance alone. These approaches also stand to benefit by using independent archaeological evidence to assess LOSA and viewshed results. For example, establishing contemporaneity between two intervisible archaeological features goes a long way towards supporting the argument they were positioned intentionally to create that intervisibility.

The last step in visibility analysis has to with demonstrating why the identified visual properties of an archaeological feature or features were significant, that is revealing the meaning behind the intention. With regards to line-of-sight networks, I argue they existed to communicate some sort of information. However, the information conveyed could pertain to any number things. LOS networks might exist to arrange rituals of integration, coordinate economic activities, alert related communities to the approach of outsiders, signal the incursion of hostile parties, maintain watch over agricultural fields, or coordinate hunting activities. Southwestern archaeological literature is prone to assess line-of-sight networks as defensive in nature (Wilcox et al. 2000; Haas and Creamer 1993), but this may have not always been the case. The trick is revealing the primary and ancillary purposes of an identified line-of-site communication network and its overall importance in the social structure.

The Archaeology of Public Architecture

Architectural remains, like the larger settlement patterns they are part of, represent the durable outlines of community organization. They are the remains of the built environment that channeled human movement through a community and provided the loci of the manifold activities of social reproduction. This is also known as structuration and occurs through the related process of praxis/habitus; cognition that human beings engage in whilst interacting with human groups and the rest of the physical world. The archaeological study of public architecture as a means to understand sociopolitical integration and interaction in the Southwest has gone on for more than 130 years (Hegmon and Lipe 1989:1). This wide ranging intellectual effort has produced myriad views on how to identify public architecture and approach its study. Those efforts most often use ethnographic analogy, functional classification of architectural space, and the analysis of settlement patterns to identify public spaces in an observed range of architectural variation (Lipe and Hegmon 1989).

Underlying this basic classificatory need and subsequent analyses are definitions of public architecture. Fish (1999:46) provides a straight forward definition of public architecture that captures its place in the built environment of human groups: "Public architecture… consists of a ritual or political edifice presumed to serve a constituency equivalent to and usually broader than the residents of the settlement in which the feature is located". Adler (1989:35) provides a similar definition of public architecture as "a structure or prepared space socially acknowledged as a context for integration of individuals above the family level". Thus the archaeology of public architecture consists of definitions that describe the prepared places of social integration, and a set of methodologies designed to identify those locations in the archaeological record and understand specifically how these contexts structured the enactment of socially integrative behavior.

The above definitions focus on integration, ritual, and social or political context to define public architecture. This constellation of terms helps to describe what actually goes on at these facilities in terms of human symbolic action and the role the built environment plays in that process. In Chapter 3 we learned that, like most other prehistoric societies in the Southwest, the Cohonina were likely organized as a non-ranked society that lacked overtly coercive leadership. In this type of organization Hegmon (1989:6) argues social integration, or the interdependence of agents (individual or collective), is achieved through complex networks of cooperation and communication that closely map onto ties of consanguinity and affinity. Cooperation and communication occur in ritual contexts; meaning a location/s where a "relatively invariant and formal sequence of actions that is established by tradition occurs" (Hegmon 1989:6). These ritual contexts do not necessarily have to be religious in nature, although religious ritual is a particularly powerful means of reaffirming an arbitrary social order and promoting solidarity by imbuing each with a sense of naturalness and sanctity.

The role of public architecture in group rituals of integration in the sorts of societies under consideration (Adler 1989) consists of two related themes. First, architecture provides a locus of enactment with definite physical boundaries. These boundaries, such as walls, reflect the intentions of their architects in that they set limits on whom or what is seen and how many individuals are allowed to participate by enclosing space and restricting access, or not. Second, public architecture plays a key role in complex symbolic systems that reinforce social structure and ideology (Hegmon 1989:7). Public architecture is constructed by culturally embedded collectivities who carry with them historically situated models of the architecture's morphology and intended uses. These models are made material by those individual's definite manipulation and appropriation of the physical environment. Thus public architecture is shaped by the historical, social, cultural, and surrounding physical contexts it rests in. Recursively, the physical characteristics of public architecture, which are replete with socio-spatial symbolism, channel the actions of its builders/users as well as influencing their perceptions.

The special symbolic requirements of public architecture and the larger social groupings this general class of structures must accommodate make them distinctive from other structures such as domiciles or more economically oriented features. A long archaeological tradition exists in the Southwest that focuses specifically on identifying public architecture through the use of some combination of ethnographic analogy, functional studies and settlement systems analysis (Lipe and Hegmon 1989:15). Ethnographic analogy serves an important function in the interpretation of architectural remains. On the Colorado Plateaus the direct historic approach has been used since the late Nineteenth century to identify kivas in prehistoric Pueblo ruins (cf. Lekson 2007). This and the use of middle-range theory have a long history of debate associated with it, especially when ethnographic analogy is used to build specific functional interpretations of public spaces identified in the archaeology record (Adler 1989:35). Debate centers on the challenges associated with these approaches. In the first instance, interpretation is based on identifying homologies which assume the form and meaning of public architecture have not deviated from one another and there are demonstrable historical continuities between the archaeological culture under study and the living culture providing the historic or ethnographic information. These are exceedingly difficult assumptions to justify, even with considerable culture-historical research. Fortunately, it appears as though stability and continuity in general meaning is more likely with increasingly complex physical manifestations of symbol (Trigger 2006:511), which public architecture certainly is. In the second instance, architectural form is correlated to a specific set of ethnographically documented behaviors or beliefs where its presence is known based on a broad cross-cultural survey. This technique works best when physical/biological laws or material properties constrain relations between material culture and behavior, as in the case of say iron smelting, but perhaps not so much in public architecture (Trigger 2006:509).

In Chapter 3 we learned of a long standing tradition in Cohonina archaeology seeking to work out functional classifications for architectural remains. This is also a general feature of Southwestern archaeology and consists of linking architectural types to activities inferred to have regularly occurred there (Lipe and Hegmon 1989:17). Architecture morphology and/or associated features and artifacts are the data these functional inferences are based on. Rather than approaching public architecture as single use structures, current approaches treat public architecture as multiple use facilities (Adler 1989). For instance, the primary intended use of Western Puebloan kivas is the enactment of group ritual, but a variety of activities also occur in these spaces ranging from the mundane to peculiarly sacred (Lipe and Hegmon 1989:18). Gross morphology of public architecture in terms of size, shape, and construction becomes the analytical starting point, which is then related to associated artifacts like floor assemblages, internal features, and the surrounding landscape. This multivariate approach stands to reveal robust and detailed functional patterning in terms of the primary and subsidiary uses of public architecture.

Lipe and Hegmon (1989:20) refer to the use of settlement systems analysis at the intersite level to approach functional classification of architectural remains as "site structure analysis". Within the arena of integrative behavior, this type of analysis attempts to use the frequency and distribution of public architecture on the landscape to infer the character of the social groups using those facilities. A basic underlying assumption to this approach is that humans position their public architecture on the landscape in relative close proximity to habitual areas of occupation. This assumption refers to the physical qualities of a community which can be defined as "a set of interrelated sites within a bounded community territory" which "contains a center with public architecture that is not duplicated in kind or magnitude in the other community sites" (Fish 1999:46). In other words, public architecture is a distinct element within a fully characterized settlement system because of its unique morphology and singular occurrence. Another assumption tied to this approach is that the "frequency and distributional regularities of integrative structures is inversely correlated with the scale or level of integration they are associated with" (Lipe and Hegmon 1989:20). For instance, if these assumptions hold true, then common and widely scattered public edifices suggest the existence of many redundant social segments. On the other hand, if public architecture is relatively scarce on the landscape, then larger and fewer social segments might have been in existence. If these observations correlate to the enclosed space of public architecture (a proxy for seating capacity) and settlement fall off (discrete settlement systems), then robust inferences pertaining to the numbers, configurations, and interconnections of communities on the landscape can be made.

The first of these techniques for identifying and exploring public architecture underpins the remaining two, but is not enough in itself to accomplish those goals. I noted earlier that Cohonina culture-history is strongly linked to that of the Western Anasazi and hence the Hopi. This provides some justification, albeit modest, for the use of the direct historic approach while exploring the role of forts in Cohonina social organization and integration. However, those historical connections are not yet well understood; meaning middle-range theory is the more solid approach in the realm of ethnographic analogy. Functional studies are a strong suit in Southwestern archaeology and the long history of this approach has produced a range of analyses that are capable of confidently inferring the specific functions of public architecture types. However, the strengths of this approach are accessible only when the researcher understands that most, if not all, public architecture types in the prehistoric Southwest were multiple use facilities. Lastly, site structure analysis based on settlement systems data provides the means to understand the full range of architectural variability within a settlement system. This allows the confident identification of public architecture based on comparisons of formal morphological variation. Understanding the position of public architecture types within the wider settlement system opens up opportunities to infer the character of the social groups that built and used those facilities. No single approach so far discussed is capable of building strong inferences concerning the role of Cohonina forts as public architecture. However, these three approaches act in concert to create a powerful battery of methodologies for identifying and exploring public architecture.

Methods

The theoretical effort just undertaken provides a robust framework within which to define what aspects of the archeological record to investigate and how that data will be collected. The ultimate goal of this thesis aims to understand the role that Cohonina forts played in social integration and interaction. The methods of survey informed by settlement archaeology constitute the behaviorally oriented foundation of that effort. Analyses of fort architecture and artifact assemblages stands to reveal how these features functioned as public space. Visibility analysis conducted within the theoretical orientation of landscape archaeology forms a complementary analysis of Cohonina forts as complex symbolic systems. The following discussion details the methods of survey, archeological chronology, and functional analysis performed for this thesis. It also details the specific approach to visibility analysis and intentionality testing I developed for this thesis.

Survey

A necessary first step to identifying and understanding public architecture is to place it within its settlement context. Identifying the full range of architectural variation within a settlement system enables the identification of those remains that most likely had a public function. This has never been accomplished for Cohonina forts, so a campaign of intensive settlement survey conducted (Cureton Ranch Reconnaissance Project [CRRP]) was undertaken around a previously investigated Cohonina fort known as the Pittsberg Fort. These efforts succeeded in identifying the remains of a Cohonina community in total by characterizing its environmental setting, structural components, and historical development (Appendix A).

Pedestrian survey was the primary method used to identify archaeological material in the project area. This effort was organized by breaking the project area into 40 acre blocks (¼ of a ¼ section). These blocks were segregated into high, medium and low priority categories based on the percentage of completed survey in a block, and currently understood patterns of Cohonina settlement. Cohonina sites tend to cluster on and around hills with site density being very low in areas of low topographic relief between hills. For this reason low priority blocks were located in the northern and southern areas of the project area where topographic relief is low and/or percentage of previously conducted survey is high. Conversely, high priority blocks clustered around Pittsberg where topographic relief is high and percentage of completed survey is low.

Survey was conducted following procedures currently used by the Kaibab National Forest (KNF). This was done in order to ensure maximum compatibility between data derived from the KNF archaeological database and data collected during survey. The primary factor influencing survey method had to do with sampling density manifested as surveyor spacing. The overwhelming majority of Cohonina sites are greater than 15m in diameter, hence the KNF spaces survey members 20m apart. Surveyors are assumed to be able to see five meters to either side of their survey transect which means a 10m wide non-surveyed zone separates each survey transect when surveyors are spaced 20m apart. This sampling density should then intersect nearly 100% of the sites in a project area. Of course, surveyors have a low likelihood of discovering isolated artifacts or features using this method, but these archaeological phenomena contribute comparatively little to the goals of this thesis.

The CRRP conducted pedestrian survey in crews of two to four persons spaced 20m apart. A crew chief used a compass to orient their team on a North-South or East-West heading. The crew then walked parallel transects on the selected heading while the crew chief maintained directional confidence with a compass. Survey crews completed blocks of either ¼-¼ or ½-¼ sections. Larger survey blocks were completed in areas where topography and vegetation allowed the survey crew to maintain directional confidence over a ½ mile transect i.e. low topographic relief and tree density. North-South or East-West oriented transects were used at the discretion of the crew chief who based their decision on topography and the number of incomplete survey blocks remaining. 1,105 acres or 78.6% of the total project area was completed in this manner. Low, medium and high priority blocks were surveyed. The NW ¼ of the SE ¼ of Section 3, Township 22 North, Range 2 East was not surveyed. Time constraints prevented survey crews from completing this medium priority block. Low priority survey blocks including the SW ¼ of the NW ¼, the W ½ of the SW ¼, SE ¼ of the SW ¼, the NE ¼ of the SE ¼, the S ½ of the SE ¼ of the SE ¼, the SW ¼ of the SE ¼ of Section 3, Township 22 North, Range 2 East were not surveyed. These survey blocks were categorized as low priority because they are located in an area of low topographic relief and have a high percentage of previously conducted survey. Time constraints prevented survey crews from completing 100% survey in these low priority blocks. When previously conducted survey (171 acres) is added to that completed by the CRRP, the total percentage of surveyed land is 1,275 acres or 90.7% of the project area.

Sites were recorded using Trimble Juno ST handheld GPS devices running ArcPad 7.01. These devices provide two to five meter GPS positioning in real time or after postprocessing. As sites were encountered a surveyor recorded a center point for the site in ArcPad and entered basic descriptive information. The survey crew then continued their transect. This approach allowed for the rapid discovery and recording of new sites during survey. After the survey and initial site recording was completed, survey crews returned with PDA devices equipped with INFRA database software to fully record sites following Kaibab National Forest protocol. This protocol was used to ensure maximum compatibility with the Kaibab National Forest archaeological database. KNF site numbers were assigned to each site. Spatial and environmental data, and land tenure status was recorded using this system. Feature and artifact descriptions, cultural designations and temporal assignments were recorded as well. Culturally or temporally diagnostic artifacts such as projectile points were drawn in plan and profile views when encountered.

Spatial information was recorded using Trimble Juno ST handheld GPS devices and hand mapping techniques. Trimble units were used to record site boundaries in ArcPad 7.01. A site recorder walked around the perimeter of the site with the Juno in hand while recording a polygon in ArcPad. The site boundary was defined as the horizontal margin where artifact density dropped below approximately 1 artifact/m^2. It is assumed that past human activity occurred throughout the project area and that traces of that behavior form a more or less continuous distribution of artifacts and features. The segregation of sites out of this continuous variation is an effort to delineate those places on the landscape where humans stayed relatively longer and did more things than other places. Thus site boundaries can be thought of as contour lines that define a spike in human activity or at least a prolonged episode of activity and hence a place of relatively greater social reproduction than the surrounding landscape. At sites where artifacts were not present, such as rock art, the site recorder walked a perimeter as close to the feature as terrain and vegetation allowed. A sketch map was drawn for each site that had surface features. At sites that consisted of only artifact scatters, a hand map was not drawn, relying instead on polygons produced with a Trimble. These polygons were ultimately integrated in ArcGIS 10 to produce the final settlement system maps used in this thesis.

Sketch maps were drawn using a compass and pacing. A surveyor would select a central point within the site and pace out to features along a specified compass heading. This method does not provide a level of accuracy achievable with the use of measuring tapes or a total station. However, the speed with which sketch maps can be drawn allows surveying teams to record sites at a much faster pace while maintaining an acceptable level of accuracy capable of accomplishing the goals of this thesis. Sketch maps focused on recording the size, shape, and morphology of discernible features within sites. Special attention was paid to sites that exhibited architectural remains so that the full range of architectural variation within the project area was recorded. These variables were then used to characterize sites based on Samples' (1992) typology of ten site types developed for pedestrian survey (see Chapter 3). At those sites exhibiting architectural remains, site function was inferred by linking Samples' typology to an expanded version of Cartledge's (1986) functionally defined architectural types. At those sites consisting only of artifact scatters and small features, site function was inferred by the artifact types present and morphology of any small features identified.

Artifact analysis was conducted in the field during site recording. Survey crews identified artifact types present and made estimates of counts based on a visual inspection of surface artifacts. At prehistoric sites survey crews focused on recording what ceramic types were present, lithic and groundstone material types present, and the stages of lithic reduction present. Ceramic types were identified based on current typologies (see Chapter 3). Projectile point types were identified based on typologies developed by Horn-Wilson (1993) and Lyndon (2005). Obsidians were identified based on descriptions provided by Shackley (2005) while other chipped stone materials were identified based on general descriptions of rock types (e.g. Chronic 1983). Identification of groundstone material types proceeded in a similar manner. Functional classes of groundstone artifacts were identified based on methods described by Adams (2002). At historic sites, analysis focused on recording any datable artifacts.

Three sites received special attention because of their unique architectural properties. First Site 03070100889, also known as the Pittsberg Fort Complex (PFC), was completely remapped using a total station and hand mapping techniques. This site was excavated by the Museum of Northern Arizona 1938 expedition (Hargrave 1938) and represents one of two sites inferred as having public architecture. The PFC is the focal point of this thesis, hence an extra effort was made to produce accurate site maps. Site 03070101467, also known as the "Sky Site" was identified as a site with unique architectural, visual, and locational properties during survey. Thus it was mapped in more detail using tape measures. Site 03070102776, also known as "Honani House" exhibits several architectural features and an unusually dense artifact scatter relative to other sites in the project area. These features were mapped in greater detail using a total station and hand mapping techniques.

Chronology

Ceramic Cross Dating (CCD) and Mean Sherd Thickness Dating (MSTD) were the two methods used to assign temporal designations to sites recorded during survey. In the case of CCD, surveyors walked the entire area of a site and noted all of the ceramic types they encountered. This information was recorded as presence/absence data. When specific types could not be identified, wares were recorded instead. The identification of ceramic wares and types followed typologies and their refinements discussed in Chapter 3. Table B.1 summarizes the current San Francisco Mountain Gray Ware typology with attendant production dates which is a synthesis of those findings from Chapter 3 and is the one used in this thesis. Table B.1 also summarizes the non-Cohonina ceramic wares and types encountered during the course of survey with their production date ranges and appropriate citations. CCD survey data was then applied to chronograms (Appendix B) to arrive at an estimated temporal assignment for the site.

MSTD data was collected according to the methodology described by Sorrell (2005). A team of two surveyors walked each site and used pin flags to randomly select 33 Floyd/Deadmans jar sherds, originating from the body of the vessel. At sites where 33 sherds could not be found, the greatest number possible was flagged. A surveyor took four thickness measurements in millimeters per sherd, using a digital caliper precise to one tenth of a millimeter. The surveyor measuring sherds called out each thickness measurement to another surveyor who recorded each measurement on a paper form. These data were later entered into Microsoft Excel where the necessary calculations were made to arrive at temporal assignments (see Appendix B).

Visibility Analysis

The goal of visibility analysis in this thesis aims to explore the possibility that specific symbols were coded in the visual properties of the Pittsberg Community's integrative facilities. The architects of the Pittsberg Fort Complex (PFC) could have placed their integrative facilities anywhere within their community area, which is defined by the maximum extent of the settlement system. However, they choose the locations they did not just because of practical exigencies such as free space, slope, and access to buildings materials; although these factors surely influenced their choices. Instead, I hypothesize that a primary factor driving their choice of public architecture location was creating and maintaining lines-of-sight with other community's integrative facilities. If this was an intention of Pittsberg architects, then their public architecture should fall within areas where they could maintain lines-of-sight with the maximum number of extra-community integrative facilities. If their public architecture does not fall within that area of visual redundancy, then intervisibility was not a primary motive of the Pittsberg architects. However, if the Pittsberg community's integrative facilities do fall within that area and that area is small relative to the total area occupied by the Pittsberg Community, then intervisibility may have been a prime motive of the Pittsberg architects.

It is possible to model the area of visual redundancy using visibility analysis and to then explore the likelihood that Pittsberg integrative facilities could have been positioned within that area by chance alone. Visibility analysis was conducted using Esri ArcGIS 10 software. Two sites within the Pittsberg Community were chosen for visibility analysis. The PFC and the Sky Site were chosen for three reasons. First, the PFC represents the only instances of the fort and extra-large pithouse classes of architecture within the Pittsberg settlement system (see Chapter 5). Therefore the site is considered an integrative facility as a whole and thus falls under the purview of the main goal of this thesis. An examination of the previously recorded Sky Site revealed that it had several unusual characteristics relative to other architectural sites in the Pittsberg community. First, it is positioned on the apex of the eastern foothill of Pittsberg. Cohonina sites tend to cluster around the flanks of hills and on ridgelines, but relatively rarely are they positioned at the apex of hills or foothills. Second, the Sky Site's position on the Pittsberg foothill affords it an unusually complete visual command of the surrounding landscape, which is not duplicated elsewhere in the Pittsberg settlement system. Lastly, this site has field checked aural and visual connectedness with the PFC. The aural connection is peculiar in that one does not have to shout from either site (more like talk in a loud voice) in order to be heard, despite being separated by almost 400 meters. The author suspects the intervening arroyo is responsible for these acoustic properties. The author – considering these observations – hypothesizes the Sky Site was intentionally positioned where it is to take advantage of those visual and auditory properties and thus was an integral element in the hypothesized larger visual communication network. Therefore, the Sky Site is considered an integrative facility in this analysis because its primary purpose may have been to delineate a location from which auditory and visual symbolic behavior was carried out as part of larger integrative rituals.

The next step in the visibility analysis consisted of creating a DEM. The source elevation data used in this analysis originated from the United States Department of Agriculture Geospatial Data Gateway (http://datagateway.nrcs.usda.gov/) and consisted of 7.5”, 10 meter resolution raster maps. These were merged in ArcGIS to create a single 10m resolution DEM modeling the entire Coconino Plateau. Ten meter resolution was chosen because it is the highest resolution data available for the Coconino Plateau. This visibility analysis is regional in scale; hence 10m DEM resolution models the landscape with sufficient fidelity. The DEM also sufficiently models the past landscape because widespread and dramatic geomorphological change has not occurred. Railroad beds, roadcuts, and some quarries are present in the DEM, but these do not significantly interfere with the visibility analysis.

The DEM is a bare-earth model which has the potential to confuse the results of the visibility analysis. Piñon-juniper woodland, grasslands, and ponderosa forest dominate the area of interest. These biotic communities are generally low to the ground (excepting ponderosa forest) with trees in piñon-juniper woodland rarely reaching more than 12m in height. On flat un-elevated ground, visibility can be low in piñon-juniper woodland. However, elevated positions provide more or less unobstructed views and individual trees are small enough to be easily pruned or removed if they are blocking visibility. Thus the DEM is assumed to sufficiently model the past landscape for this visibility analysis in spite of the tree-problem.

Single unrestricted viewsheds were calculated from the PFC and the Sky Site to model what can be seen from those sites. I assumed that an observer would have stood atop the fort at the PFC, or the sole building at the Sky Site. Thus the observer point was set as the center of these features. I assumed that these buildings had flat roofs no less than two meters above the ground surface. This is a conservative estimate of roof height and morphology, both of which are attested in the archaeological record (see Chapter 3). I assumed an average eye level height of 1.5m for the observer based on across the board stature estimates for prehistoric Southwestern Native Americans (Scott 1981; Ravesloot and Regan 2000:70-71) which agree with the limited skeletal series of the Cohonina (Smithwick 1977). This average aims to include the possibility that men, women, or pubescent children all could have participated in observation and communication. Thus the total offsets used for this visibility analysis were 3.5 meters for both sites. I produced unrestricted viewsheds for two reasons. First, I wanted to model the greatest possible visibility assuming excellent viewing conditions which can allow the discernment of large landscape features up to 100km away from certain vantage points (personal observation). Second, topography on the Coconino Plateau naturally restricts viewsheds. Finally, I allowed for the curvature of the Earth in the viewshed analysis (available as an option in the "Viewshed Tool" in ArcGIS 10.0).

After I created viewsheds from the PFC and Sky Site, I combined them to create a multiple viewshed which models what can be seen from both sites simultaneously. I then used the resulting shapefile to capture all known Cohonina sites exhibiting architectural remains (assumed to capture any public architecture) within the Kaibab National Forest Archaeological Database shapefile (Williams and Tusayan Districts) that fall within that multiple viewshed. I examined the resulting dataset and associated site cards for examples of public architecture which might include forts, plazas, extra-large pithouses, and ballcourts.

The results captured three sites previously classified as public architecture (03070100301, Kaibab Fort; 03070200132, Twin Fort [fort]; and 03070200152, Walavudu [plaza]) and one site newly classified as public architecture (03070200836, Cedar House [extra-large pithouse]). The Sitgreaves settlement system contains 17 examples of public architecture: 13 extra-large pithouses, two forts, and two plazas. Seven of the 13 extra-large pithouses fell within the Pittsberg multiple viewshed while one fort and one plaza also fell within the multiple viewshed. Walavudu is the only plaza that fell within the multiple viewshed and was the only public site within the Sitgreaves settlement system considered for further analysis. Walavudu is the largest and most centrally located integrative facility in the Sitgreaves settlement system. I assume it acted as the central place for social integration within the Sitgreaves Community and thus the integrative facility most likely to have been the intended target of inter-community line-of-sight communication. However, this might not have been the case, but investigating the visual properties of all public architecture sites within the Sitgreaves settlement system is well beyond the scope of this thesis.

I created single unrestricted viewsheds for the Kaibab Fort, Cedar House, and Walavudu. These viewsheds used the same parameters as the Pittsberg viewsheds. These viewsheds have two purposes. First, they confirm whether or not the PFC and the Sky Site are intervisible with the Kaibab Fort, Cedar House, and Walavudu. Second, I used these viewsheds to model the area of visual redundancy within the Pittsberg settlement system; that is the area where an observer could maintain lines-of-sight with the Kaibab Fort, Cedar House, and Walavudu simultaneously.

I also modeled likely areas Pittsberg architects would consider building public architecture. I argue that among the myriad considerations reckoned by Pittsbergers in their selection of building sites, the slope of terrain within the Pittsberg Community was a primary one. In particular, I argue the Cohonina of Pittsberg preferred flatter over steeper terrain upon which to construct buildings. I determined the mean slope of sites with substantial architecture (habitation sites) within the Pittsberg settlement system to model those areas the Pittsbergers considered flat enough to build. I determined those areas within the Pittsberg settlement system with $-1\ \sigma°$ slope to $\bar{x}°$ slope which models "optimal" slope conditions and those areas with $\bar{x}°$ slope to $+1\ \sigma°$ slope to model "less than optimal", but still flat enough slope conditions. Areas with slope values greater than $+1\ \sigma°$ slope were considered "too steep" to build upon. This slope model allows comparisons between those areas that are too steep to build, or flat enough to build with those areas within and without the area of visual redundancy. These comparisons should allow me to thoroughly test whether or not the Pittsberg Fort Complex and the Sky Site were intentionally positioned on the landscape to maintain intervisibility with the Kaibab Fort, Cedar House, and Walavudu.

Summary

This chapter provided a theoretical framework to guide the collection, analysis, and interpretation of the archaeological data produced by the Cureton Ranch Reconnaissance Project. Settlement and landscape archaeology informed by GIS provide a strong theoretical stance from which to examine Cohonina social integration and interaction from the perspective of the Pittsberg Community. The archaeology of public architecture provides another theoretical building block that allows the rigorous analysis and interpretation of Cohonina Forts. Finally visibility analysis carried out within this theoretical framework stands to access Cohonina cognition in the form symbolic systems coded into their public architecture's position on the landscape. The success of this latter effort depends on my ability to demonstrate intentionality in intervisibility. The results of the Cureton Ranch Reconnaissance Project survey, archaeological chronology, functional analyses of Cohonina Forts, and visibility analysis are all presented in Chapter 5.

CHAPTER 5: DATA COLLECTION RESULTS AND ANALYSES

In this chapter I present the results of survey, architectural studies, and GIS based visibility analysis. I discuss the results of the Cureton Ranch Reconnaissance Project (CRRP) which I created to carry out a complete settlement systems survey around The Pittsberg Fort Complex (NA3577, 03070100889). The CRRP produced the raw survey data upon which my subsequent analyses rest. I describe how many sites and of what kind makeup the Pittsberg settlement pattern. I discuss and analyze the relationship between site function and site location. I also characterize the history of settlement around Pittsberg. I move on to discuss how to define the boundaries of the Pittsberg settlement system based on those spatial and temporal analyses. I discuss how the Pittsberg Fort Complex (PFC) fits into the overall settlement pattern, whether or not it should be characterized as public architecture on the basis of site structure analysis, and if so, whether or not the PFC is the only example of public architecture within the Pittsberg settlement system. I also describe and discuss the results of a functional analysis of Cohonina Forts which examines gross architectural features and floor assemblages between four Cohonina forts for which excavation data exists. Finally I describe and discuss the results of visibility analysis which explores line-of-sight connections between the PFC and other sites on the landscape.

Survey Results

The Cureton Ranch Reconnaissance Project (CRRP) carried out survey between June 12 and August 10, 2011 on Cureton Ranch and Kaibab National Forest Lands (Figure 5.1). The project was partially supported by the Kaibab National Forest (KNF) where survey was

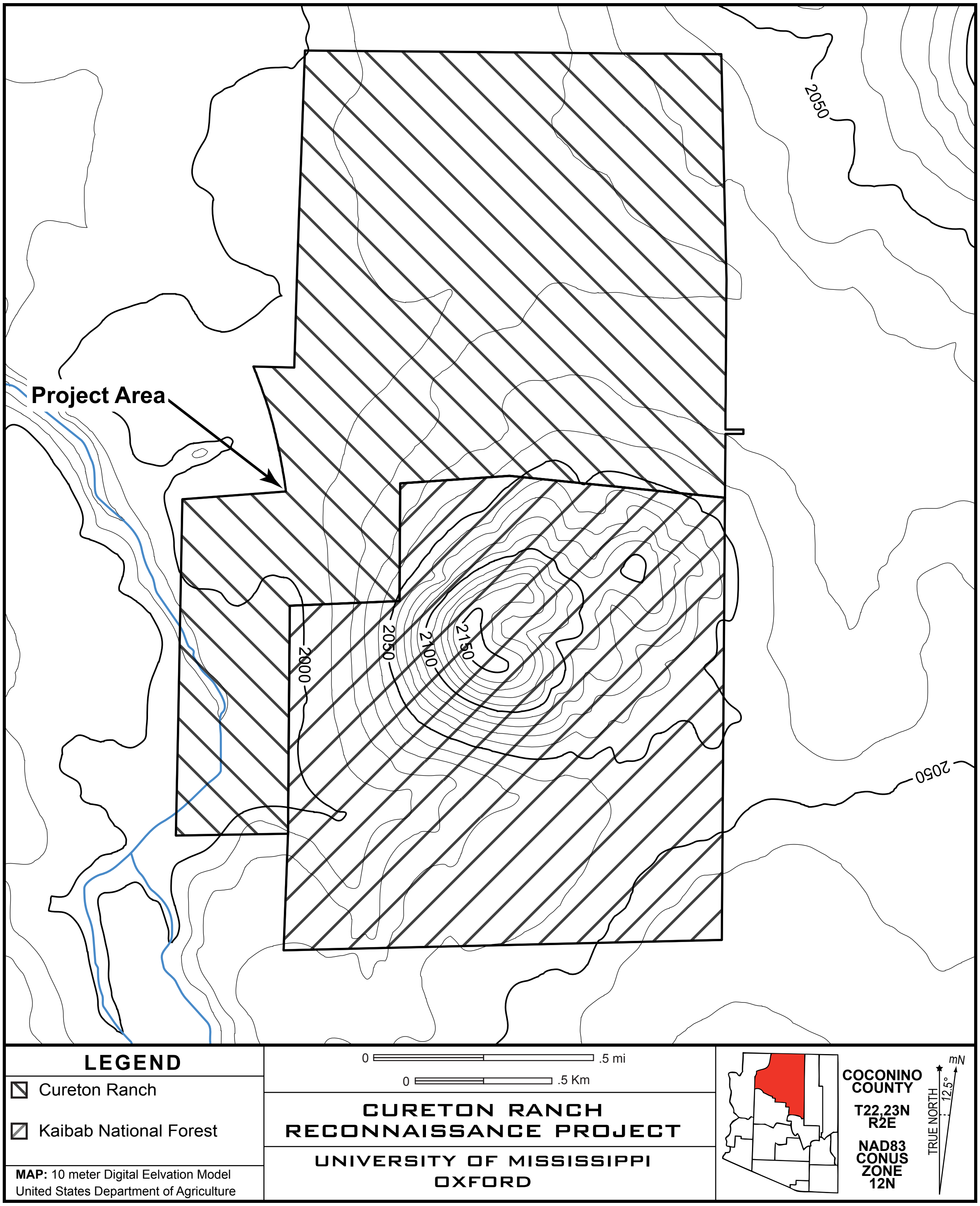

Figure 5.1. The project area.

conducted on forest lands (South Zone Archaeologist, Neil Weintraub, contact person). The Cureton Ranch provided the remainder of project funding and support where survey was conducted within its boundaries.

Friends and family members of Travis Cureton volunteered 94 person/hours while surveying 786 acres of the Cureton Ranch under the supervision of Travis Cureton. The Kaibab National Forest Heritage Team under the supervision of Neil Weintraub committed 64 person/hours to completing 319 acres of survey on forest lands. This effort resulted in 1,105 surveyed acres within the project area. When this figure is combined with previous survey conducted on behalf of the KNF, total survey coverage comes to 1,275 acres or 90.7% of the project area (Figure 5.2). Thirty-seven sites were encountered during the survey (Figure 5.3, Table 5.1), of which 18 are located on the Cureton Ranch, 15 are located on Kaibab National Forest lands and 4 that are positioned on both Cureton Ranch and Kaibab National Forest Lands. Five of the 37 sites are Historic Euroamerican, 26 are Formative Cohonina, 1 is Archaic Basketmaker II, and 5 are Aceramic. Site descriptions and maps are presented in Appendix A. The results of Ceramic Cross Dating and Mean Sherd Thickness Dating are presented in Appendix B along with a short discussion on their correspondence and acceptability of the results. Although numerous "isolated" artifacts were encountered during survey, these were not the primary focus of the study and hence were not collected or recorded (see Chapter 4). The dearth of Basketmaker II sites is interesting, but not altogether unexpected. Although Lyndon (2005) demonstrated a definite Basketmaker II presence on the Coconino Plateau, that presence may have been low impact.

Museum of Northern Arizona (MNA) archives, The Kaibab National Forest (KNF) archeological database, and AZSITE archives were examined to determine the number of archaeological sites previously recorded within the project area. The 1938 MNA Expedition to Sites North of Williams, Arizona represents the earliest professional archaeological work done within the project area. Museum of Northern Arizona archived items that have site location information for this expedition consist sketch maps, photographs, site cards, and index cards. These records indicate nine sites were recorded near the project area during that expedition, four

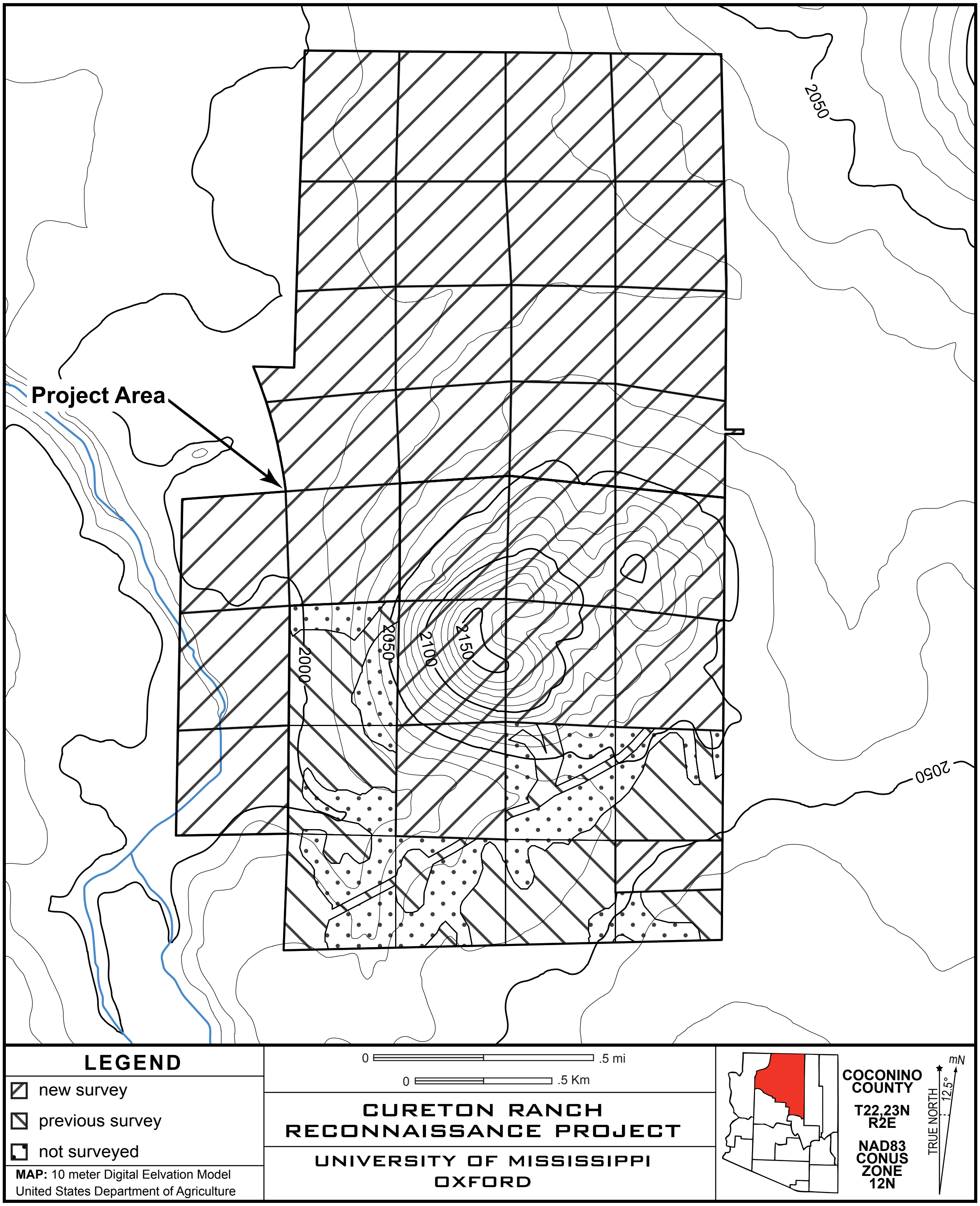

Figure 5.2. Completed survey within the project area.

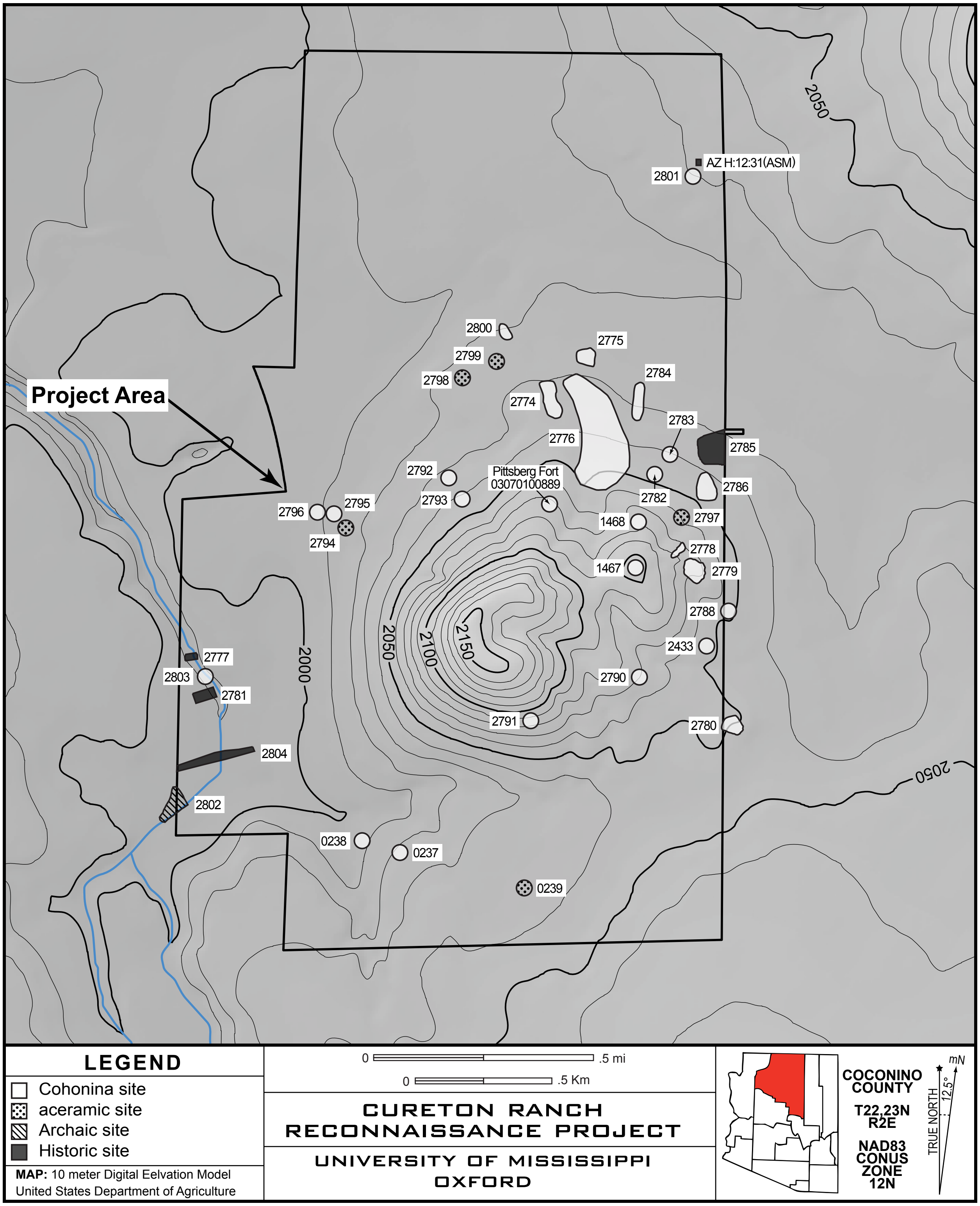

Figure 5.3. Sites located during survey within the project area.

Table 5.1. Sites discovered during survey.

USFS SITE NUMBER	LAND STATUS	PERIOD	CULTURE
03070102802	Cureton Ranch & Kaibab National Forest	Archaic	Baketmaker II
03070100239	Kaibab National Forest	Aceramic	Unknown
03070102794	Cureton Ranch	Aceramic	Unknown
03070102797	Cureton Ranch	Aceramic	Unknown
03070102798	Cureton Ranch	Aceramic	Unknown
03070102799	Cureton Ranch	Aceramic	Unknown
03070100237	Kaibab National Forest	Formative	Cohonina
03070100238	Kaibab National Forest	Formative	Cohonina
03070100889	Kaibab National Forest	Formative	Cohonina
03070101467	Kaibab National Forest	Formative	Cohonina
03070101468	Kaibab National Forest	Formative	Cohonina
03070102433	Kaibab National Forest	Formative	Cohonina
03070102774	Cureton Ranch	Formative	Cohonina
03070102775	Cureton Ranch	Formative	Cohonina
03070102776	Cureton Ranch & Kaibab National Forest	Formative	Cohonina
03070102778	Kaibab National Forest	Formative	Cohonina
03070102779	Kaibab National Forest	Formative	Cohonina
03070102780	Kaibab National Forest	Formative	Cohonina
03070102782	Cureton Ranch	Formative	Cohonina
03070102783	Cureton Ranch	Formative	Cohonina
03070102784	Cureton Ranch	Formative	Cohonina
03070102786	Cureton Ranch & Kaibab National Forest	Formative	Cohonina
03070102788	Kaibab National Forest	Formative	Cohonina
03070102790	Kaibab National Forest	Formative	Cohonina
03070102791	Kaibab National Forest	Formative	Cohonina
03070102792	Cureton Ranch	Formative	Cohonina
03070102793	Cureton Ranch & Kaibab National Forest	Formative	Cohonina
03070102795	Cureton Ranch	Formative	Cohonina
03070102796	Cureton Ranch	Formative	Cohonina
03070102800	Cureton Ranch	Formative	Cohonina
03070102801	Cureton Ranch	Formative	Cohonina
03070102803	Cureton Ranch	Formative	Cohonina
03070102777	Cureton Ranch	Historic	Euroamerican
03070102781	Cureton Ranch	Historic	Euroamerican
03070102785	Cureton Ranch	Historic	Euroamerican
03070102787	Cureton Ranch	Historic	Euroamerican
03070102804	Cureton Ranch	Historic	Euroamerican

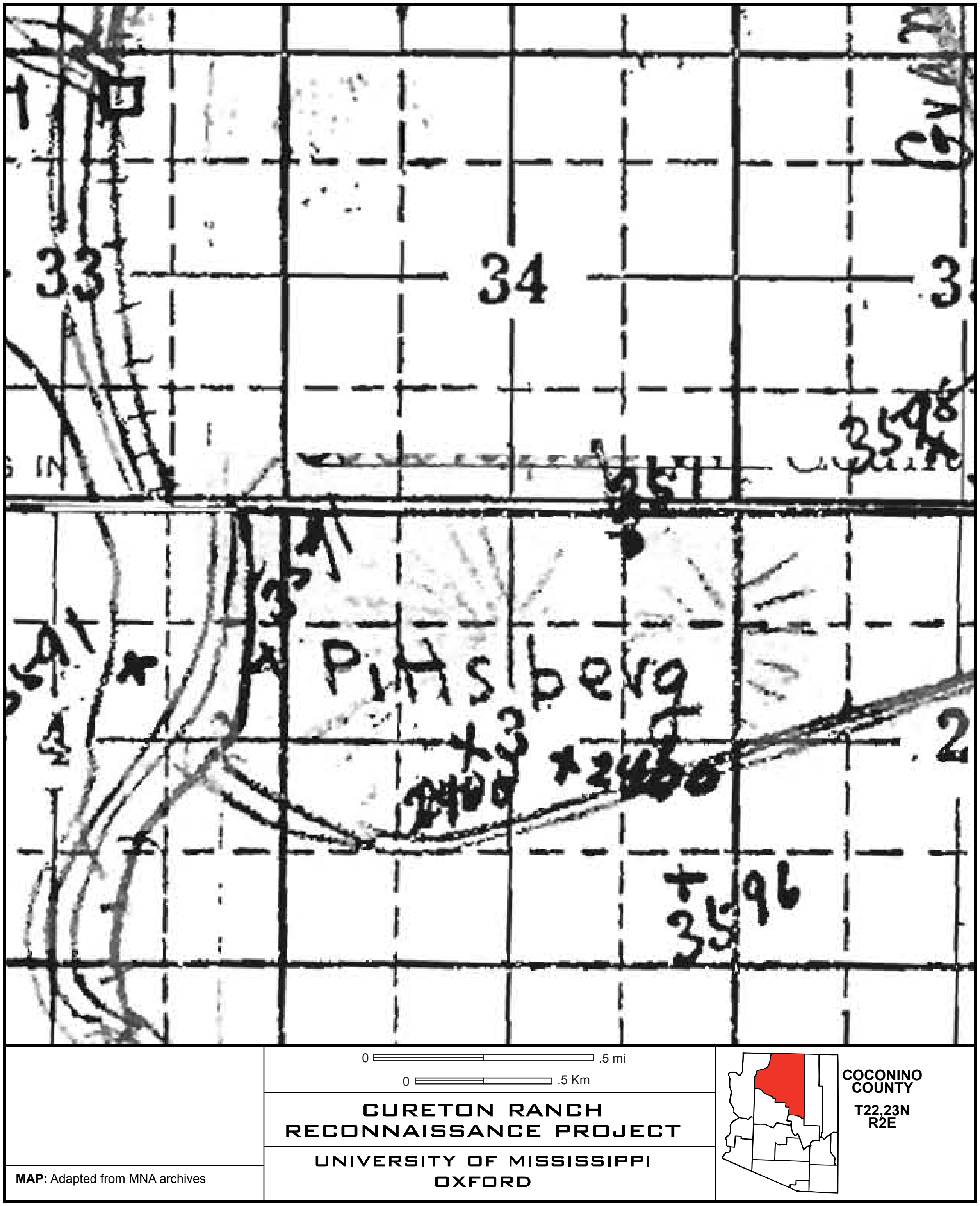

Figure 5.4. Site locations from the 1938 MNA expedition near the project area.

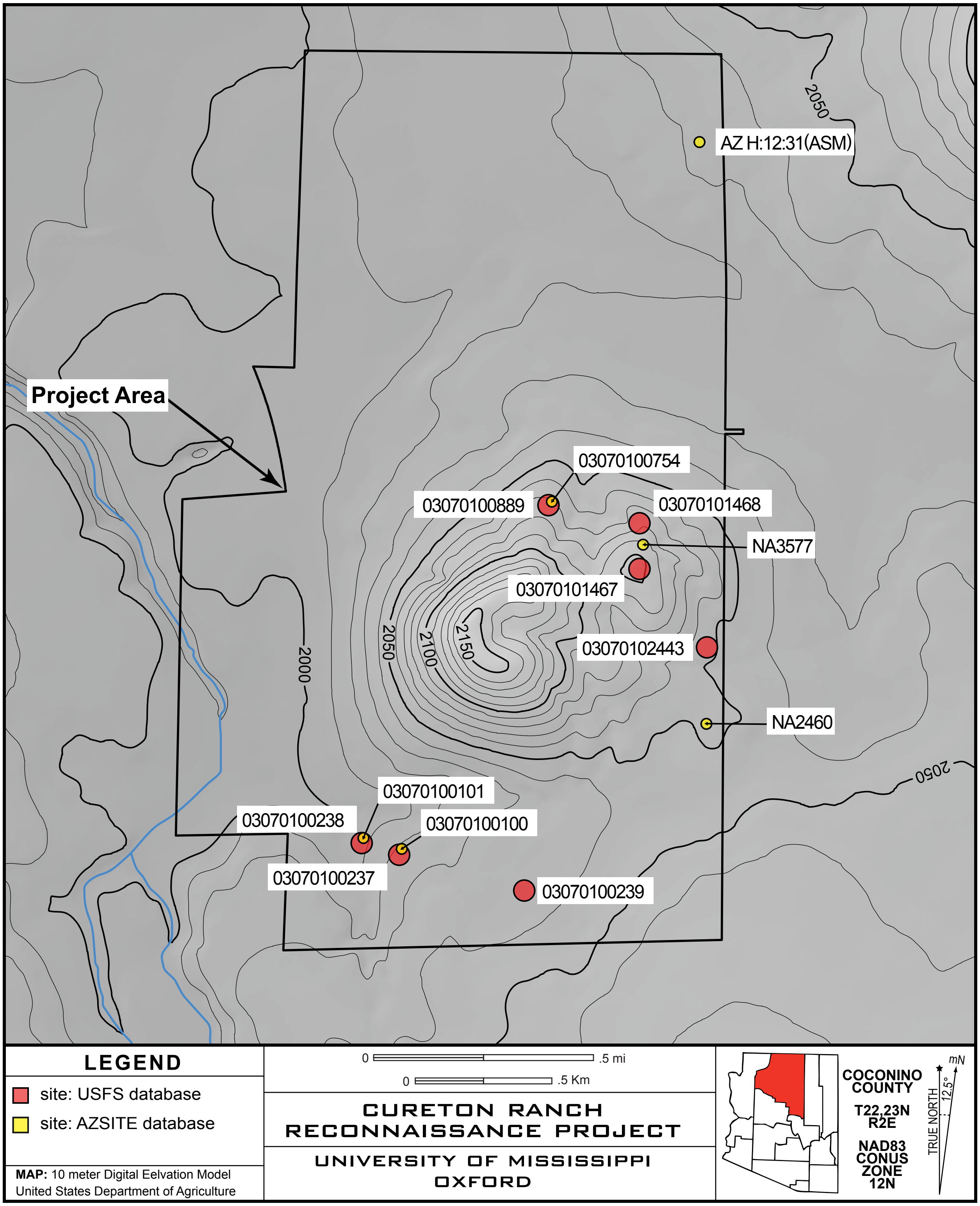

Figure 5.5. Previously recorded sites within the project area.

Table 5.2. Sites near the project area recorded during the 1938 MNA expedition.

Site Tally	N.A. Site Number	Date Recorded	Date Excavated	Description
1	2400	10/7/1937 Colton	6/10/1938 Hargrave & Taylor	brush huts
2	2460	10/7/1937 Colton & Bartlett	6/6/1938 Hargrave, Wetherill & Taylor	several pithouses
3	3574	No Data	No Data	flake scatter
4	3576	No Data	No Data	depression
5	3577	06/13/1938 Schroeder	1938	fort
6	3591	7/9/1938 Wetherill & Schroeder	1938 Schroeder & Solenberger	rockshelter
7	3596	8/1/1938 Schroeder	Not Excavated	sherd area
8	3597	8/5/1938 Wetherill	Not Excavated	Petroglyph
9	3598	8/5/1938 Colton, Hargrave & Schroeder	Not Excavated	sherd area

Table 5.3. Previously recorded sites within the project area according to AZSITE.

Site Tally	AZSite Number	Period	Culture	Description
1	03070100100	Archaic	No Data	No Data
2	03070100101	Formative	Cohonina	No Data
3	03070100754	Formative	Cohonina	No Data
4	AZ H:12:31 (ASM)	Historic	Euroamerican	habitation or trading post
5	NA2460	No Data	No Data	No Data
6	NA3577	No Data	No Data	No Data

of which were excavated (Figure 5.4, Table 5.2). The Arizona State Historic Preservation Office (ASHPO) maintains AZSITE which is a statewide online database containing archaeological site and survey information pulled from a variety of sources. AZSITE records indicate five sites are located within the project area (Figure 5.5, Table 5.3). Finally, the KNF archaeological database indicates seven sites are located within the project area (Figure 5.5, Table 5.4)

Reconciling site locations and descriptions from these three sources with the results of the current survey proved exceedingly difficult. Museum of Northern Arizona site maps are

Table 5.4. Previously recorded sites within the project area, KNF archaeological database.

Site Tally	AZSite Number	Period	Culture	Description
1	03070100237	Formative	Cohonina	artifact scatter
2	03070100238	Formative	Cohonina	artifact scatter
3	03070100239	Aceramic	Unknown	lithic scatter
4	03070100889	Formative	Cohonina	Pittsberg Fort
5	03070101467	Formative	Cohonina	masonry structure
6	03070101468	Formative	Cohonina	structure
7	03070102433	Formative	Cohonina	structures

only useful for locating sites to within about one-half of a mile of their actual location. These are often little more than sketch maps whose geographic information is quite distorted relative to the Public Land Survey System that forms their base. AZSITE records proved to be completely inaccurate in terms of site locations and names, despite it being a GIS maintained by the ASHPO. The Kaibab National Forest archaeological database is the only data source that contained accurate spatial and attribute data for archaeological sites within the project area. Thus it became the foundation upon which new survey data could be reconciled with old survey data.

The CRRP relocated one AZSITE recorded site, all seven KNF recorded sites and four of the nine MNA recorded sites (Figure 5.6 and Table 5.5). The single AZSITE recorded site was

Table 5.5. Relocated sites.

USFS SITE NUMBER	AZSITE NUMBER	MNA SITE NUMBER	SITE DESCRIPTION
03070100237			Cohonina artifact scatter
03070100238			Cohonina artifact scatter
03070100239			lithic scatter, unknown antiquity
03070100889		NA3577	Pittsberg Fort Complex, Cohonina
03070101467			Cohonina masonry structure
03070101468			Cohonina masonry and jacal structure
03070102433			Cohonina masonry and jacal structures
03070102780		NA2460	Cohonina masonry structure
03070102787	AZ: H:12:31(ASM)		Historic roadside camp or trading post
03070102790		NA3597	Cohonina petroglyph panal
03070102803		NA3591	Fat Lizard Rock Shelter, Cohonina

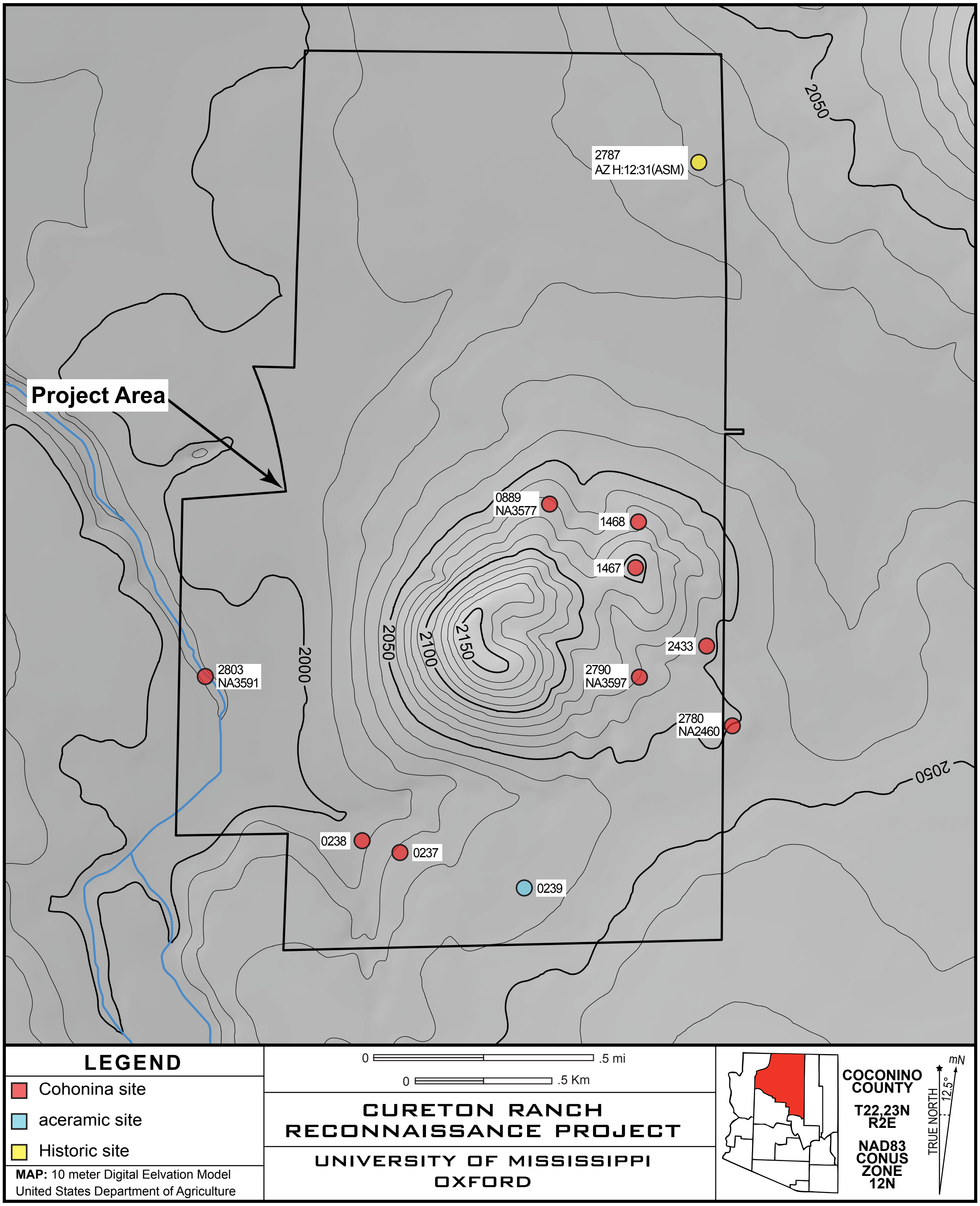

Figure 5.6. Relocated sites.

relocated by matching on the ground observations to site descriptions. Surveyors relocated KNF recorded sites by matching the latitude and longitude of site locations encountered during survey with those contained in the KNF archaeological database. Relocation was confirmed by matching KNF site descriptions with archaeological phenomena observed on the ground. Surveyors relocated MNA recorded sites through a combination of matching feature descriptions and photographs taken during the 1938 expedition to on the ground phenomena. Appendix A contains a discussion of those sites that were relocated and how.

General Characteristics of the Pittsberg Settlement System

The Cureton Ranch Reconnaissance Project achieved over 90% survey coverage of the project area when combined with previous survey on Kaibab National Forest (KNF) lands. This exceptional survey coverage delineated the overwhelming majority of sites within the project area. Although Late Archaic and Late Historic sites were found along with Aceramic sites that could date to any period, these are excluded from further analysis. The focus of this discussion is on the remains of the Pittsberg Community; that is, the remains of Cohonina settlement around Pittsberg (Figure 5.7).

The majority of Cohonina sites cluster on the east side of Pittsberg, with the densest concentration of activity centered on the northeast slope of Pittsberg. Sites 0237, 0238, 2801, and 2803 appear to be outliers in the settlement system. Site 2801 is an artifact scatter positioned in a small wash and thus likely represents eroded artifacts originating from sites positioned on the southern slopes of the Dolly Parton Hills. However, time constraints prevented the CRRP from investigating this possibility. Sites 0237 and 0238 are small artifact scatters and were included in the Pittsberg settlement because they lie closer to that system than next nearest settlement cluster located on Kaibab Hill to the south. Site 2803 is a rockshelter positioned on the east bank of Cataract Creek, which is the closest known source of water to the main settlement cluster around

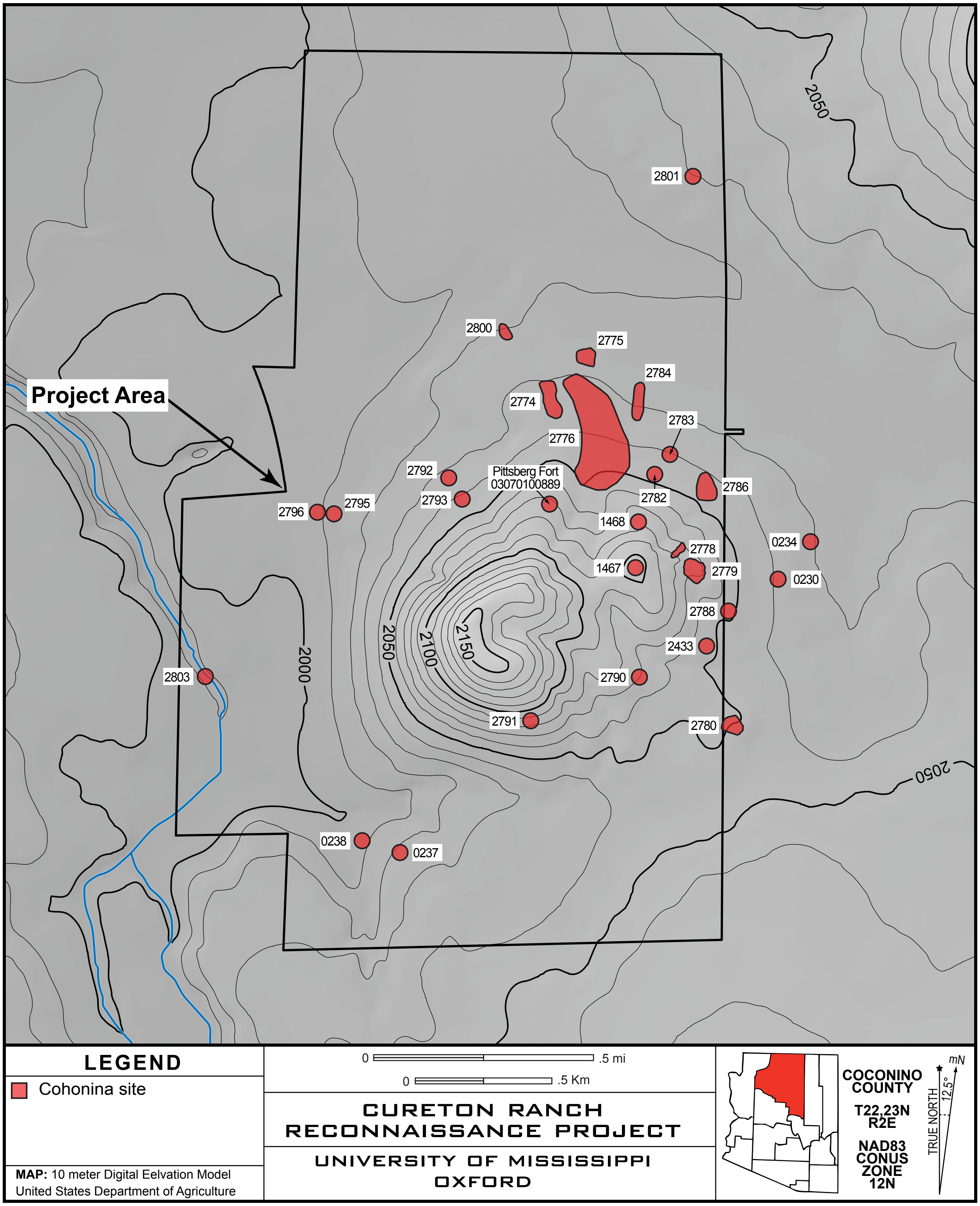

Figure 5.7. The Pittsberg settlement system.

Pittsberg. Thus it is reasonable to argue Site 2803 is attributable to the Cohonina of Pittsberg and not some other community.

The Cohonina Settlement Pattern

When Cohonina settlement within the project area is sorted into a modified version of Samples' (1992) site typology based on surface remains (Table 5.6) certain site types predominate. Of the 26 Cohonina sites in the project area 3 (12%) are ceramic and lithic scatters, 1 (4%) is a ceramic and groundstone scatter, and 6 (23%) are ceramic, lithic, and groundstone scatters. Three (12%) sites are artifact scatters that have at least one feature consisting of an amorphous

Table 5.6. Pittsberg settlement system sites sorted by surface morphology.

Site Type	Count	Percent
Ceramic and Groundstone Scatter	3	12
Ceramic and Lithic Scatter	1	4
Ceramic, Lithic, Groundstone Scatter	6	23
Artifact Scatter and Amorphous Rubble	3	12
Circular Depression and Amorphous Rubble	1	4
Circular Depression and Surface Masonry	2	8
Surface Masonry, 1-3 courses	6	23
Surface Masonry, 4+ courses	1	4
Rock Art	2	8
Rockshelter	1	4

Note: Percentage total equals more than 1 because of rounding.

concentration of architectural rubble. One (4%) site consists of circular depressions and a pile of amorphous rubble, while 2 (8%) sites consist of at least one circular depression and one example of recognizable surface masonry. Six (23%) sites exhibit recognizable masonry construction with one to three courses in situ. One (4%) site exhibits intact masonry higher than four or more courses. Two (8%) rock art sites are present in the project area as well as one rockshelter (4%). Ceramic, lithic, and groundstone scatters and sites exhibiting one to three courses of intact masonry are the most common sites in the Pittsberg settlement system. Rockshelters and sites with four or more intact courses of masonry are the rarest.

When Cohonina settlement around Pittsberg is sorted into a modified version of Cartledge's (1986) functional site categories, bolstered by excavation data from the Sitgreaves settlement system (Samples 1992) (Table 5.7), a clearer picture of settlement structure emerges. I inferred that artifact scatters of any composition are loci of primarily economic activity such as gathering camps and the like, as opposed to habitations or integrative facilities, based on the presence of tools and the lack of substantial architectural features. I typed these as "logistical" and ten (38%) are present in the Pittsberg settlement system. Those sites exhibiting artifact scatters and piles of amorphous rubble I consider to be equivalent to Cartledge's "ramada" functional

Table 5.7. Pittsberg settlement system sites sorted by function.

Functional Class	Count	Percent
Logistical	10	38
Ramada	3	12
Small Masonry and Jacal	3	12
Unit Structure	2	8
Shallow Pithouses and Ramada	1	4
Shallow Pithouses and Small Masonry and Jacal	1	4
Shallow Pithouses and Unit Structures	1	4
Ritual	3	12
Integrative	2	8

class of architecture, of which three (12%) are present. These sites probably served a primarily economic function, but required a more formal work or rest area. Surface masonry structures with one to three intact courses of masonry were likely small jacal structures with a short masonry foundation. I typed these as "small masonry and jacal structures" and three (12%) are present in the Pittsberg settlement system. Two (8%) sites are recognizable as "unit structures" which consist of formal north-south arrangements of attached masonry and jacal rooms. Three sites exhibit circular depressions which I infer belong to Cartledge's "shallow pithouse" class. However, each of the three sites presents a pairing of shallow pithouses with a different functional class. One each of these pithouse sites is paired with a ramada, small masonry and jacal structure, or unit structure. I placed the two rock art sites and the rockshelter site into a "ritual" functional class. These sites may have been loci of integrative behavior, but were not likely to have involved more than a few people. It is possible that the rockshelter served a more logistical function such as a hunting camp, but the presence of rock art at this site and the Cohonina use of rockshelters as ritual forums (see Medicine Cave [Colton 1946]) suggest otherwise. Finally, two (8%) sites were classed as “integrative”. Logistical sites are far and away the most common functional class within the Pittsberg settlement system while isolated unit structures, and integrative sites are comparatively rare.

In order to gain a broad understanding of settlement structure and locations of various behaviors within the Pittsberg settlement system, I collapsed the before mentioned nine functional classes into four broad functional classes. Doing so reveals a clear picture of Cohonina settlement at Pittsberg in terms of where people were carrying out economic activities, building their domiciles, locating their ritual places, and positioning their public architecture. I collapsed all logistical sites and ramadas into one “logistical” functional class. These places of primarily economic activity make up one half (13) of all sites within the Pittsberg settlement system (Table 5.8, Figure 5.8). Shallow pithouses, small masonry and jacal structures, and unit structures

Table 5.8. Pittsberg settlement system sites sorted by four functional classes.

Functional Class	Count	Percent
Logistical	13	50
Habitation	8	31
Ritual	3	12
Integrative	2	8

functioned as components of domestic space. These structures were the places of day to day social reproduction; where the members of the Pittsberg community built their implements of production, stored their food, slept, ate, reproduced, and raised their children. Therefore I combined these functional classes into one broad “habitation” class consisting of 8 (31%) sites within the Pittsberg settlement system. I maintained the “ritual” and “integrative” classes because qualitatively different behavior was going on at sites belonging to these two classes. The small spaces of ritual sites suggest a more intimate setting than the large built environment and comparatively

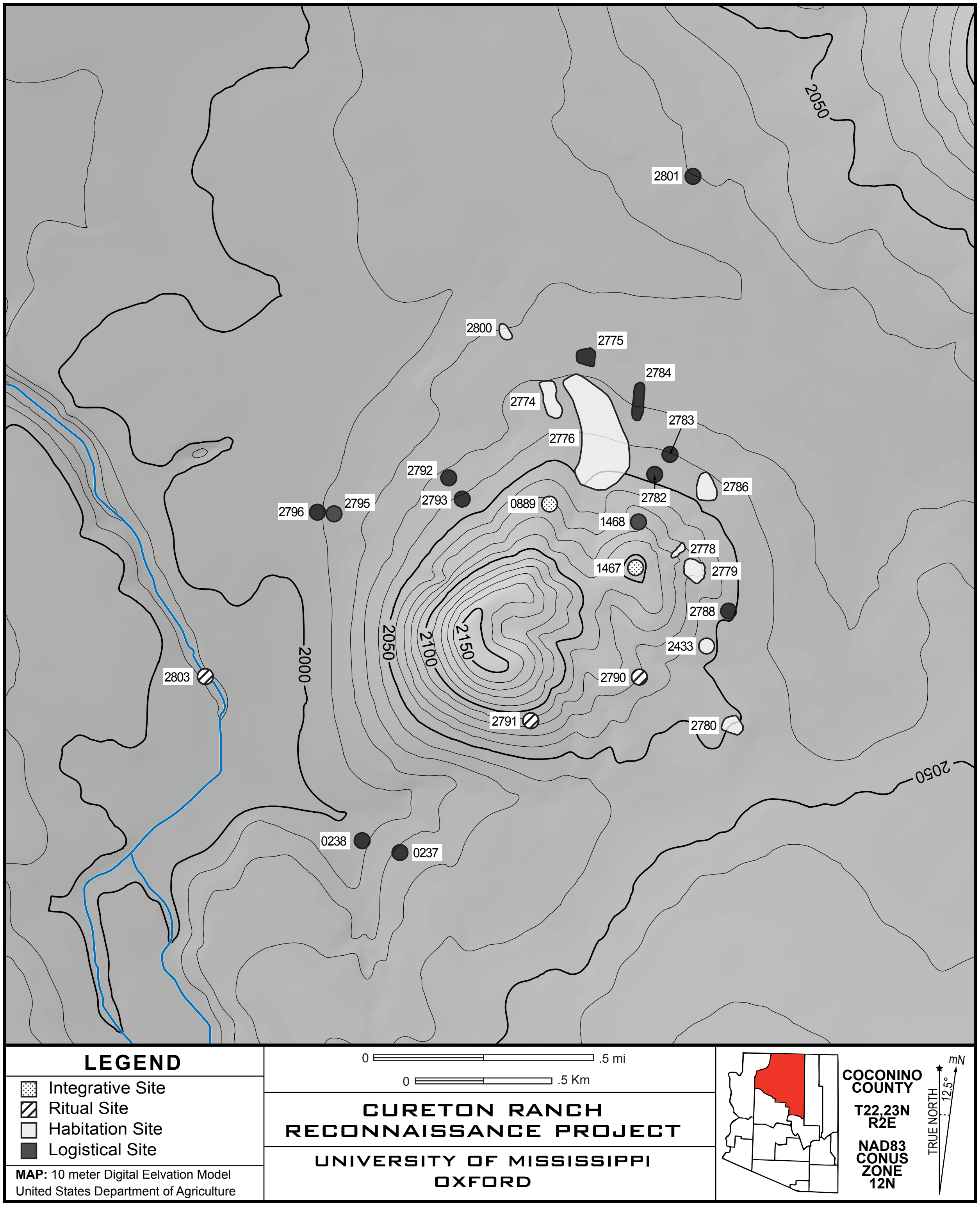

Figure 5.8. Four functional site classes within the Pittsberg settlement system.

expansive space of the two identified public architecture sites. Although the preceding discussion produced a functional classification of sites around Pittsberg, a word of caution is in order here. The functional classifications of "logistical," "habitation," "ritual," and "integrative" represent a typology which arbitrarily dissects the archaeological record. While this is not, in itself poor practice, it would be foolish to assume this typology directly reflects past reality and the inferred behaviors occurred exclusively at those sites. The typology aims to isolate the *primary* behavior carried at each site in the settlement system in a range of possibilities.

Cohonina Settlement Chronology at Pittsberg

Ceramic Cross Dating (CCD) and Mean Sherd Thickness Dating (MSTD) were the two methods of archaeological chronology used to assign dates to Cohonina sites during the course of the CRRP. The results of that effort are presented in Appendix B. I seriated sites within the Pittsberg settlement system using MSTD dates, and in the absence of those, I used the midpoint of the CCD dates (Figure 5.9, Table 5.9). Mean Sherd Thickness data indicate the Pittsberg Community was founded about A.D. 950 and persisted until about A.D. 1150. Ceramic Cross Dating largely confirms this, but leaves open the possibility for a pre-A.D. 800 (Hermit phase) founding of the Pittsberg community. This occupation does not contradict current models of settlement change in the Cohonina core area. It also matches rather closely the development of the well studied Sitgreaves Community about 10km to the east (Cartledge 1979; Samples 1992). The following discussion assesses the development of the Pittsberg Community by phase.

There may or may not have been a Cohonina presence at Pittsberg during the Hermit Phase (Figure 5.10). While no site dating only to that phase was found, two sites (Site 2776 [Honani House] and Site 2782) both exhibit the Hermit phase marker ceramic type Lino Black-on-grey (A.D. 550 to 800). At the logistical Site 2782, Lino Black-on-grey is the only ceramic type present besides Floyd/Deadmans Gray. The MSTD for the site (A.D. 991 ± 42yrs.)

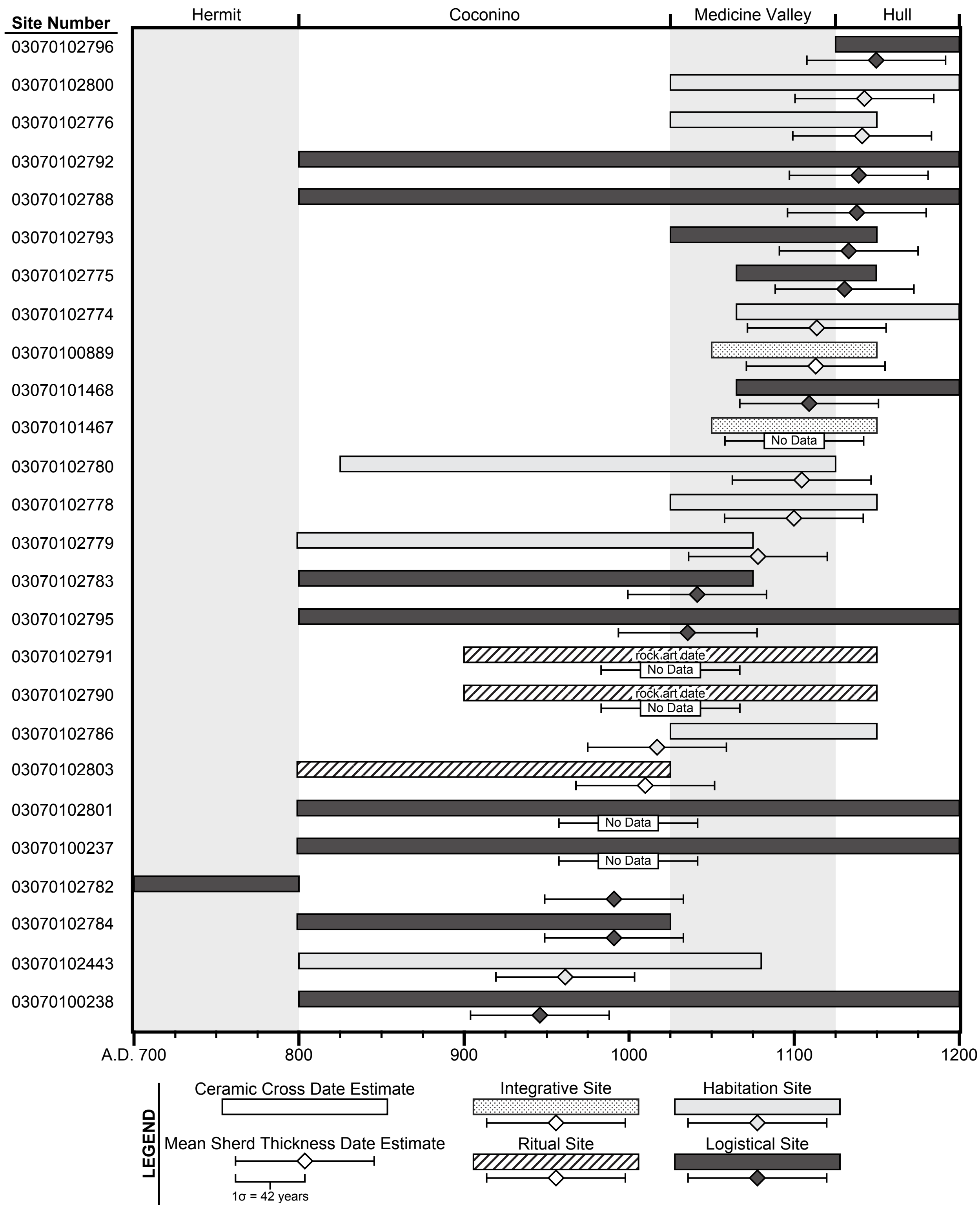

Figure 5.9. Pittsberg settlement system chronology.

Table 5.9. Pittsberg settlement system chronology.

		Ceramic Cross Dates		Mean Sherd Thickness Date		
USFS Site Number	**Broad Functional Categories**	**Early**	**Late**	**Early**	**Mean**	**Late**
03070100230	Logistical	A.D. 1025	A.D. 1125	-	-	-
03070100234	Logistical	A.D. 1025	A.D. 1125	-	-	-
03070100237	Logistical	A.D. 800	A.D. 1200	-	-	-
03070100238	Logistical	A.D. 800	A.D. 1200	A.D. 904	A.D. 946	A.D. 988
03070100889	Public Architecture	A.D. 1050	A.D. 1150	A.D. 1071	A.D. 1113	A.D. 1155
03070101467	Public Architecture	A.D. 1050	A.D. 1150	-	-	-
03070101468	Logistical	A.D. 1065	A.D. 1200	A.D. 1073	A.D. 1115	A.D. 1157
03070102433	Habitation	A.D. 800	A.D. 1080	A.D. 934	A.D. 976	A.D. 1018
03070102774	Habitation	A.D. 1065	A.D. 1200	A.D. 1072	A.D. 1114	A.D. 1156
03070102775	Logistical	A.D. 1065	A.D. 1150	A.D. 1088	A.D. 1130	A.D. 1172
03070102776	Habitation	A.D. 1025	A.D. 1150	A.D. 1103	A.D. 1145	A.D. 1187
03070102778	Habitation	A.D. 800	A.D. 1200	A.D. 1058	A.D. 1100	A.D. 1142
03070102779	Habitation	A.D. 800	A.D. 1075	A.D. 1036	A.D. 1078	A.D. 1120
03070102780	Habitation	A.D. 800	A.D. 1200	A.D. 1063	A.D. 1105	A.D. 1147
03070102782	Logistical	A.D. 550	A.D. 800	A.D. 949	A.D. 991	A.D. 1033
03070102783	Logistical	A.D. 800	A.D. 1075	A.D. 999	A.D. 1041	A.D. 1083
03070102784	Logistical	A.D. 800	A.D. 1025	A.D. 949	A.D. 991	A.D. 1033
03070102786	Habitation	A.D. 1025	A.D. 1150	A.D. 975	A.D. 1017	A.D. 1059
03070102788	Logistical	A.D. 800	A.D. 1200	A.D. 1096	A.D. 1138	A.D. 1180
03070102790	Ritual	A.D. 900	A.D. 1150	-	-	-
03070102791	Ritual	A.D. 900	A.D. 1150	-	-	-
03070102792	Logistical	A.D. 800	A.D. 1200	A.D. 1087	A.D. 1139	A.D. 1171
03070102793	Logistical	A.D. 1025	A.D. 1150	A.D. 1093	A.D. 1135	A.D. 1177
03070102795	Logistical	A.D. 800	A.D. 1200	A.D. 993	A.D. 1035	A.D. 1077
03070102796	Logistical	A.D. 1125	A.D. 1200	A.D. 1108	A.D. 1150	A.D. 1192
03070102800	Habitation	A.D. 1025	A.D. 1200	A.D. 1100	A.D. 1142	A.D. 1184
03070102801	Logistical	A.D. 800	A.D. 1200	-	-	-
03070102803	Ritual	A.D. 800	A.D. 1025	A.D. 968	A.D. 1010	A.D. 1052

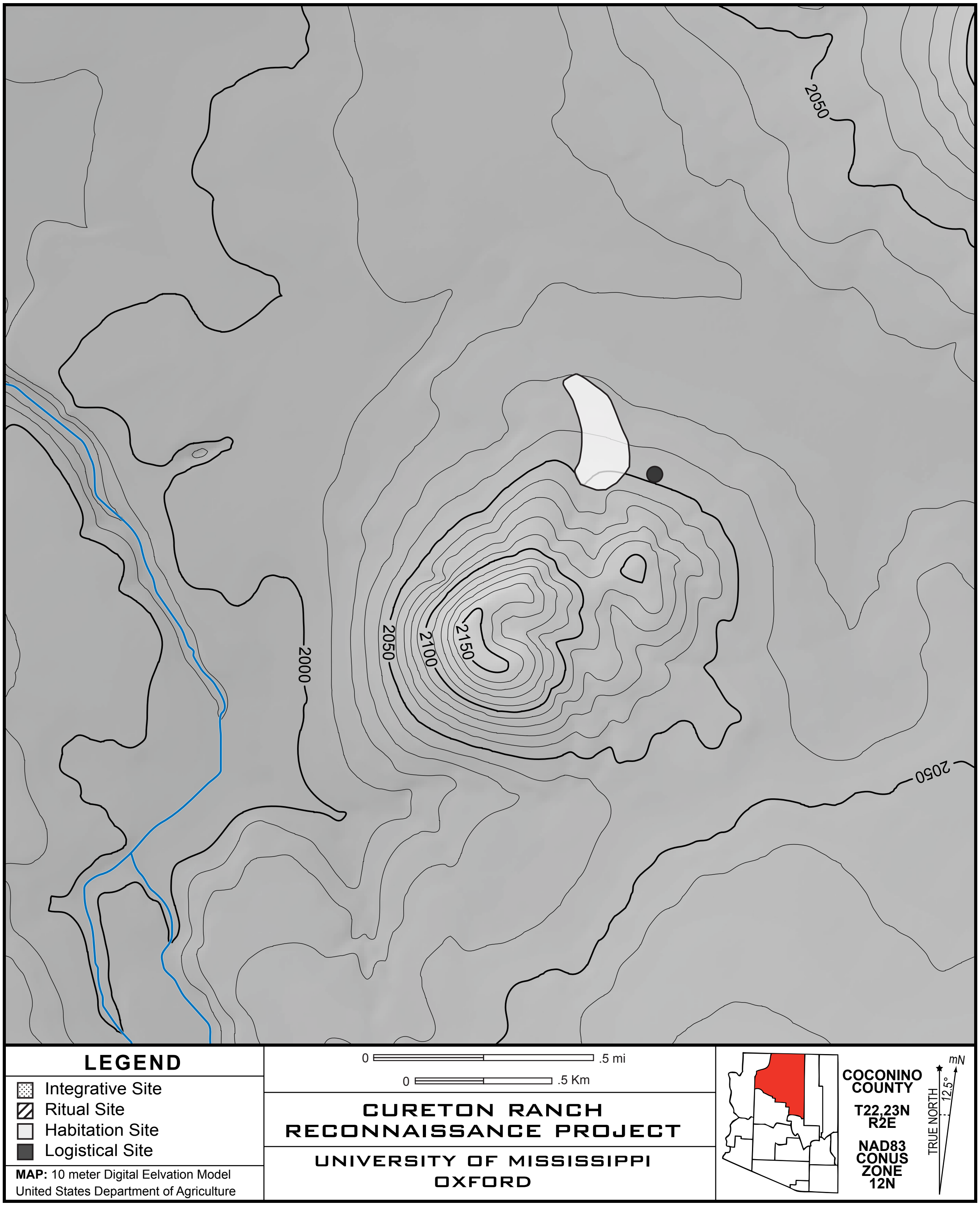

Figure 5.10. Pittsberg settlement system, Hermit phase.

disagrees with that temporal assessment. However, the MSTD for Site 2782 is also the only dramatic outlier in a comparison of CCD and MSTD dates (see Appendix B). This is not entirely unexpected since we learned in Chapter 4 that Sorrell's (2005) original data upon which the current use of MSTD is based is weak for the Hermit Phase. Thus it is best to allow the possibility that Site 2782 dates to the Hermit Phase. Honani House (Site 2776) is a habitation site that also exhibits Lino Black-on-grey in small, but appreciable quantities. The CCD date for Honani House is based on the ubiquitous presence of Black Mesa Black-on-white (A.D. 1025 to 1150) which agrees with a MSTD date of A.D. 1145 (± 42yrs.). However, Lyndon (2005) pondered the possibility that Coconino and Medicine Valley phase occupations are masking earlier Hermit phase occupations at long lived sites, which could be the case at Honani House. Alternatively, the presence of Lino Black-on-grey at Honani House might represent heirloom items from the founding of the Pittsberg Community. Taken together, the data suggest it is best to allow the possibility that Honani House was in existence from the Hermit Phase on.

The Pittsberg Community expanded during the Coconino phase to include 3 logistical sites, 3 habitation sites, and 3 ritual sites (Figure 5.11). There was some activity at Honani House during the Coconino Phase, MSTD date notwithstanding. Floyd Gray, Floyd Black-on-grey, and Kana-A Black-on-white are all present at this site; all of which are markers of the Coconino phase. Two rock art sites (2790 and 2791) may date to the Coconino phase, but this is not a firm assessment because temporally diagnostic artifacts are lacking at these sites and Christensen's (2004:47) identification of a Cohonina style in the Anasazi tradition dating between the Pueblo II and III periods is still tentative and does not distinguish between phases. Site 0238, a logistical site, produced the earliest MSTD date (A.D. 946 ± 42yrs.) in the Pittsberg settlement system. This small ceramic and lithic scatter likely represents a very short period of activity. Site 0237 is a similar site, morphologically and probably temporally. However, sheet erosion has nearly obliterated this site which prevented the CRRP from collecting MSTD data from it.

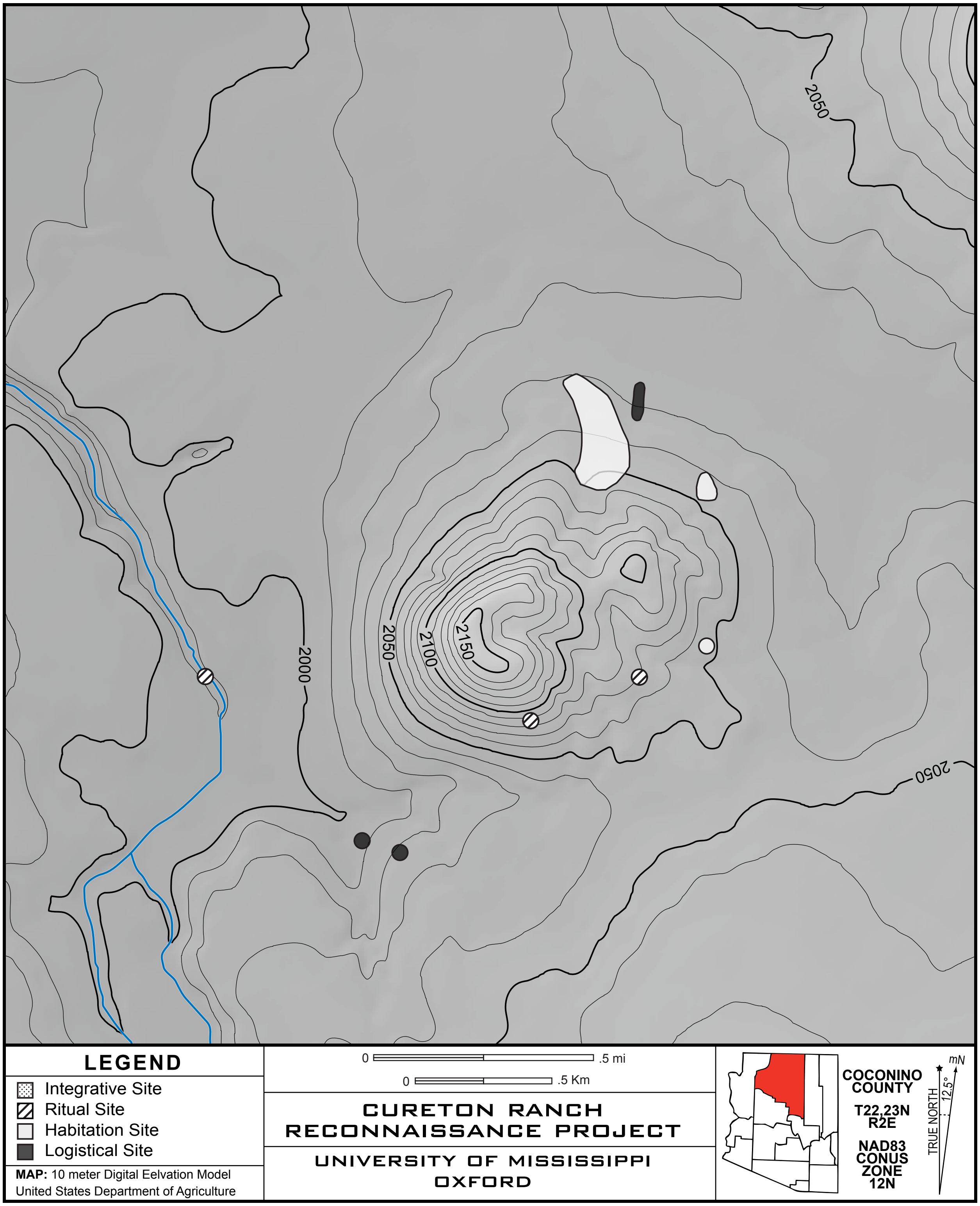

Figure 5.11. Pittsberg settlement system, Coconino phase.

The Fat Lizard Rock Shelter (Site 2803) is another Coconino Phase site with a problematic assemblage. This rock shelter site produced a MSTD date of A.D. 1010 (± 42yrs.) which agrees with the presence of Floyd Black-on-grey at the site. However, Horn-Wilson (1997) classed a projectile point collected from the site in 1938 as "Desert Side-notched" (A.D. 1300 to 1600). In fact, projectile points dating from the Late Archaic through the Protohistoric periods were noted around the Fat Lizard Rockshelter during the CRRP. Thus it appears Cataract Creek around Fat Lizard Rockshelter was a locus of near constant human activity from at least the Late Archaic on. Regardless, the correspondence of CCD dates and MSTD dates suggest the Cohonina use of the rockshelter dates to the Coconino phase. The presence of rock art at this site also lends support to the notion that Sites 2790 and 2791 date to the Coconino phase. The logistical Site 2784 and habitation site 2786 represent an expansion of settlement on the northeastern flank of Pittsberg while Site 2433 represents the first habitation site on the southeastern slope.

The Pittsberg Community expanded substantially during the Medicine Valley phase (Figure 5.12). Settlement growth consisted of the addition of four habitation sites mostly on the northeast slope of Pittsberg. Honani House continued to be occupied and the bulk of the archaeological record at that site likely dates to the Medicine Valley phase. The CCD date for the habitation Site 2786 places it in the Medicine Valley phase while the MSTD date placed it in the Coconino phase. Therefore it is best to leave open the possibility that the site was founded in the late Coconino phase and continued to be occupied during the Medicine Valley phase. Although the number of logistical sites remained steady into the Medicine Valley phase (Sites 1468, 2795, and 2783), economic activity shifted to the north slopes of Pittsberg. Two additional logistical sites (0230 and 0234) lying just east of the project area were part of the Pittsberg settlement system during this phase as well. The habitation Site 2780 and logistical Site 2795 appear as isolates on the southeastern and northeastern slopes of Pittsberg respectively.

Two integrative facilities were built during the Medicine Valley phase. The Pittsberg Fort Complex (PFC) is the biggest of these and tree-ring dates place the construction of this integrative space rather confidently between A.D. 1051 and 1053. Its position just upslope from Honani

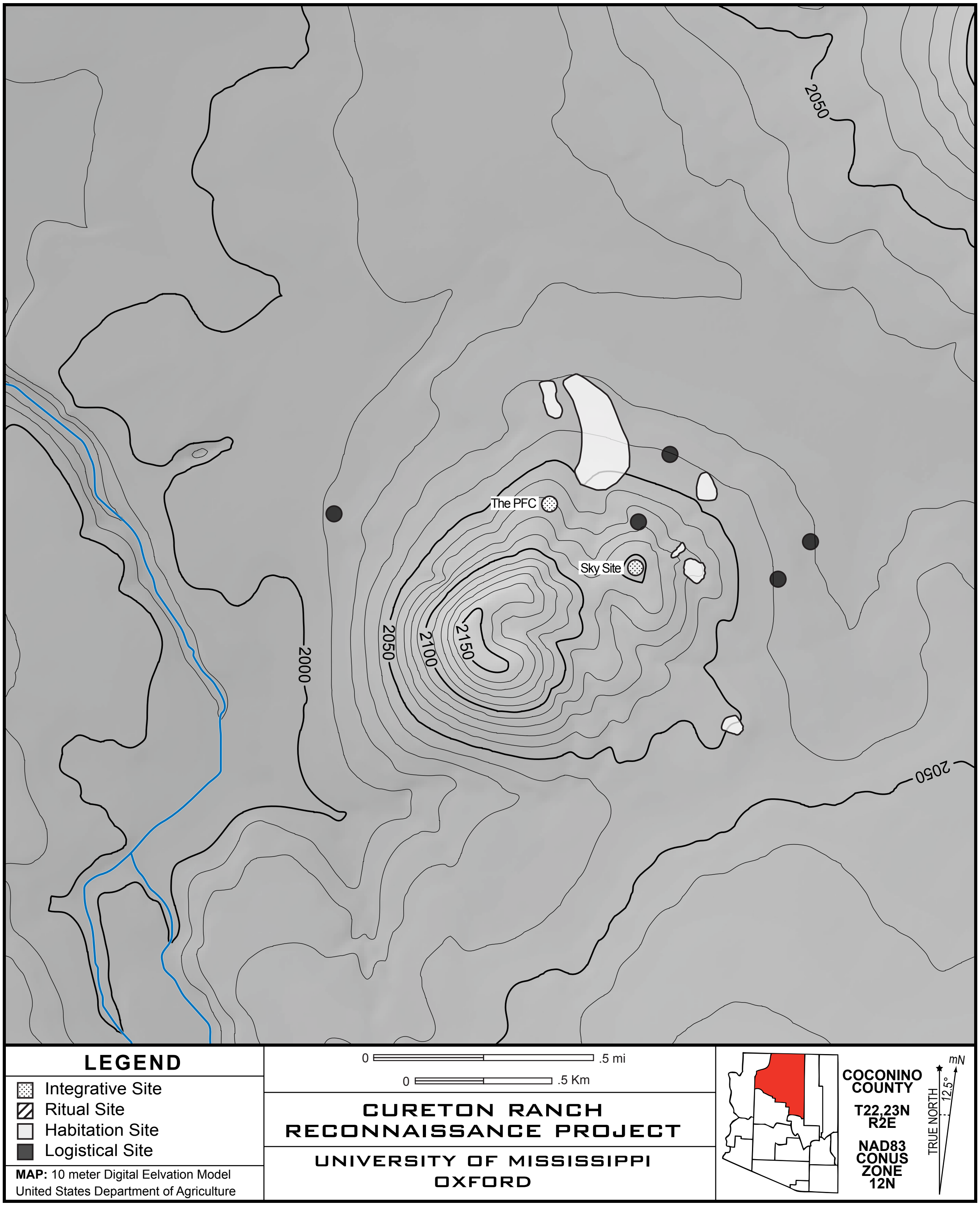

Figure 5.12. Pittsberg settlement system, Medicine Valley phase.

House, the largest and longest lived habitation within the settlement system, is noteworthy. The Sky Site (Site 1467) is the second integrative facility built during the Medicine Valley phase. The building at this site is smaller than the PFC, but its unusual position within the settlement system affords it a near 360° viewshed of the surrounding landscape, making it stand out as a peculiar place within the Pittsberg Community. Also, the Sky Site has unusually clear aural and visual connections with the PFC which has led the author to hypothesize this site played an important role in integrative ritual within and without the Pittsberg community.

The composition of the Pittsberg Community changed considerably during the Hull phase (Figure 5.13). Settlement shifted onto the north slope of Pittsberg while the number of habitation sites decreased by half and the number of logistical sites doubled. The occupation of Honani House continued as evidenced by the presence of Citadel Polychrome and Moenkopi Corrugated. Site 2774, a habitation, may have continued to be occupied during the Hull phase while another small habitation (Site 2800) was built to the northwest. Logistical sites (6) doubled during the Hull phase when compared to Medicine Valley phase. Site 2796, a logistical site, is the latest dated site (A.D. 1150 ± 42yrs., MSTD) within the Pittsberg settlement system and appears as an isolate on the northeastern slope of Pittsberg.

Tree-ring evidence suggests the Pittsberg Fort Complex (PFC) persisted until at least A.D. 1065 before all of its buildings were consumed by fire (Ahlstrom 1982; Downum 1988). If Elson's (2011) dating of the Sunset Crater eruption between A.D. 1080 and 1085 holds up, then the presence of the post-eruptive Alameda Brown Ware types Winona Brown and Winona Smudged on the floor of Structure A suggest the PFC survived well into the late 1080s. However, the absence of Flagstaff Black-on-white (A.D.1150 to 1225) suggests fire consumed the PFC before A.D. 1150. Finer temporal resolution concerning the date the PFC conflagration is not currently possible. The presence of Black Mesa Black-on-white and Tusayan Corrugated opens up the possibility that the second integrative facility within the Pittsberg Community (Sky Site) could have persisted until A.D. 1150. Finally, an A.D. 1150 demise of the Pittsberg Community correlates well with a period of profound drought on the Colorado Plateaus (ca. A.D.

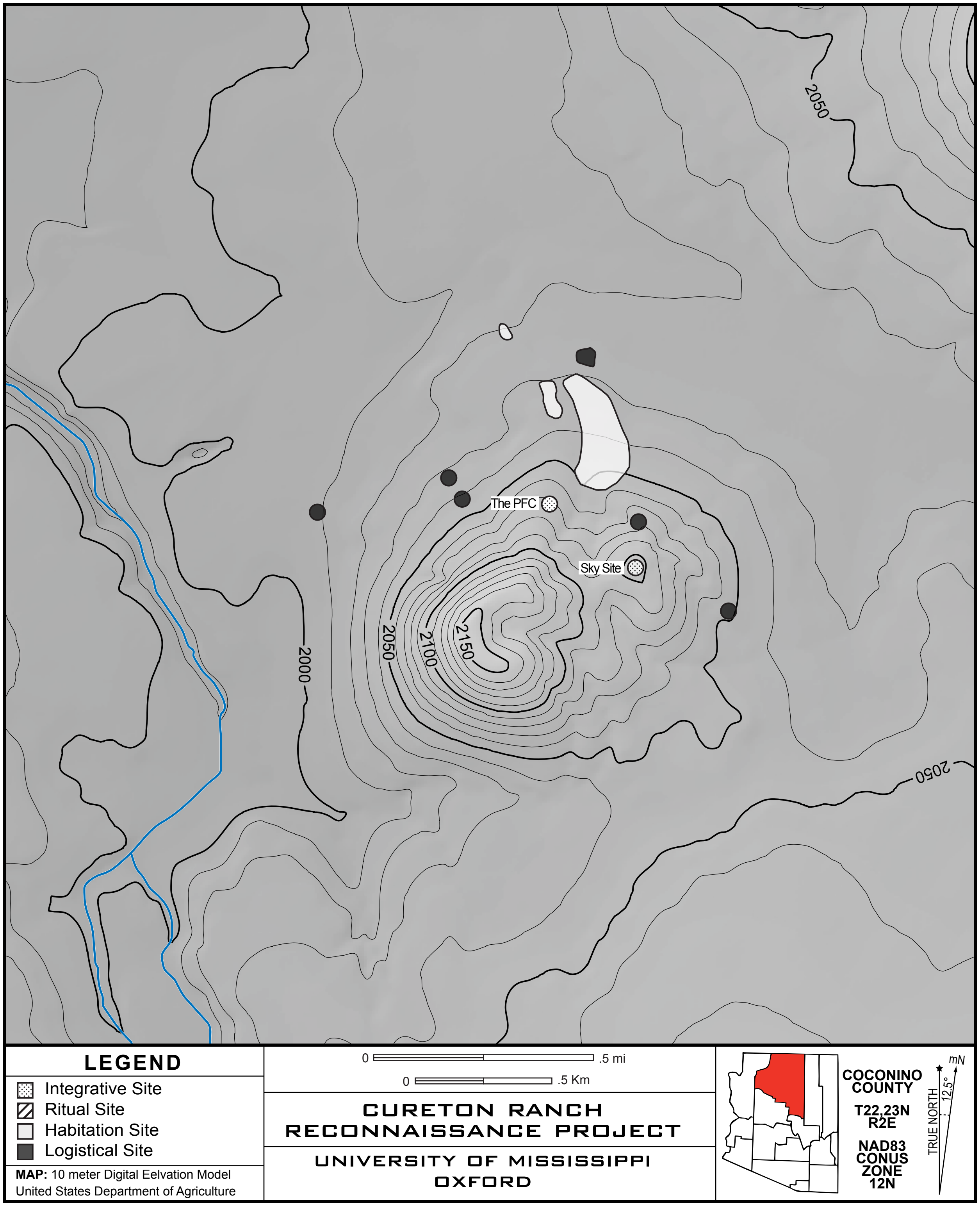

Figure 5.13. Pittsberg settlement system, Hull phase.

1140s, see Chapter 2), opening up the possibility that the Pittsbergers chose to move away from Pittsberg in the face of deteriorating climatic conditions.

Biotic Community, Elevation, and Slope

I will examine three site variables in order to investigate the relationship between site location and site type and how these are related to local environmental conditions at Pittsberg. These results can then be compared to the one other intensive settlement systems analysis conducted for a Cohonina community (Samples 1992). Sites are located within one biotic community in the Pittsberg settlement system. Every Cohonina site encountered during the CRRP is located in Great Basin Conifer woodland, also known as piñon-juniper woodland. Two sites (2800 and 2803) deviate only slightly from this pattern in that they are located adjacent to isolated stands of ponderosa pine. That every site in the Pittsberg settlement system is located in piñon-juniper woodland is noteworthy because three biotic communities are present within project area today (see Chapter 2) and Samples (1992:69) found that Sitgreaves Community sites fell in piñon-juniper woodland and ponderosa pine communities (Rocky Mountain [Petran] and Madrean Montane conifer forests). A similar mix of biotic communities likely existed in the project area in the period between A.D. 950 and 1150 as does today. There may have been more piñon-juniper woodland than today, with a greater ratio of piñons over junipers. Ponderosa stands may have been modestly bigger and grasslands may have taken up less area than today. But the overall dominance of piñon-juniper woodland has probably been the case around Pittsberg for at least the last thousand years.

The mean site elevation within the Pittsberg settlement system is 2,044m and the standard deviation is 28m (Table 5.10). The total vertical difference from the highest elevation site (Site 1467, Sky Site) and the lowest site (Site 2803, Fat Lizard Rock Shelter) in the settlement system is 115m. When compared to the Sitgreaves settlement system (Samples 1992:72), Pittsberg

Table 5.10. Elevation of Pittsberg settlement system sites.

Elevation	All Pittsberg Sites n=26	Logitical n=13	Habitation n=8	Ritual n=3	Integrative n=2
Minimum	1,989m	2,008m	2,021m	1,989m	2,072m
Maximum	2,104m	2,077m	2,076m	2,085m	2,104m
Mean	2,044m	2,033m	2,049m	2,048m	2,087m
Standard Deviation	28m	19m	17m	51m	23m
Median	2,041m	2,030m	2,047m	2,070m	2,088m

sites are positioned in a tighter elevation range and are lower in elevation as a whole. The most interesting pattern in the Pittsberg data is the elevation differences between the four broad functional classes of sites (Table 5.10). The average elevation of logistical sites is lower than that of habitation sites. The sample of ritual and integrative sites is too small within the Pittsberg settlement system to make many generalizations, but it is interesting that they are generally the sites with the highest elevations, Site 2803 notwithstanding. Note that the integrative Sky Site has the highest elevation of any site in the Pittsberg settlement system.

Samples (1992:70) observed that the slope of the terrain within the Sitgreaves settlement system influenced site location with 85% of those sites occurring on terrain that slopes three degrees or less. A similar, but weaker pattern, is repeated in the Pittsberg data with 75% of sites occurring on terrain that slopes eight degrees or less (Table 5.11) (slope was calculated in ArcGIS 10.1 as an average within site polygons). This indicates the Pittsbergers chose to position themselves on slightly steeper terrain than the Sitgreaves folk. Site 2791, a rock art site, has the steepest surrounding terrain in the Pittsberg settlement system, while Site 2780 has the flattest surrounding terrain. When degrees slope is compared between the four broad functional classes of sites (Table 5.12) the mean degrees slope of logistical and habitation sites are under six degrees, while ritual sites have mean degrees slope over eight degrees. Integrative sites fall in between the previous classes at about eight degrees slope. This patterning might reflect the desire for flat terrain was a critical factor Pittsbergers weighed when choosing where to construct their buildings or set up their work camps. Ritual sites stand out in that they are generally located on

Table 5.11. Average slope of terrain within Pittsberg settlement system sites.

	All Sites		Logistical		Habitation		Ritual		Public	
Degrees Slope	**Freq.**	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**
0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2	2	7.7	0	0.0	1	12.5	1	33.3	0	0.0
3	4	15.4	4	30.8	0	0.0	0	0.0	0	0.0
4	4	15.4	2	15.4	2	25.0	0	0.0	0	0.0
5	2	7.7	0	0.0	2	25.0	0	0.0	0	0.0
6	4	15.4	4	30.8	0	0.0	0	0.0	0	0.0
7	3	11.5	1	7.7	1	12.5	0	0.0	1	50.0
8	2	7.7	0	0.0	0	0.0	1	33.3	1	50.0
9	2	7.7	1	7.7	1	12.5	0	0.0	0	0.0
10	1	3.8	1	7.7	0	0.0	0	0.0	0	0.0
11	1	3.8	0	0.0	1	12.5	0	0.0	0	0.0
12	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
13	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
14	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
15	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
16	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
17	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
18	1	3.8	0	0.0	0	0.0	1	33.3	0	0.0

Table 5.12. Summary of Pittsberg settlement system slope data.

Degrees Slope	All Pittsberg Sites n=26	Logitical n=13	Habitation n=8	Ritual n=3	Integrative n=2
Minimum	1.47°	2.37°	1.47°	1.63°	6.66°
Maximum	17.90°	9.17°	10.98°	17.90°	7.88°
Mean	5.71°	4.86°	5.48°	9.02°	7.27°
Standard Deviation	3.56°	2.31°	3.14°	8.24°	0.86°
Median	5.31°	5.22°	4.38°	7.54°	7.27°

steeper terrain. Overall the slope data suggest the Cohonina of Pittsberg desired to carry out their daily lives on relatively flat terrain.

Defining the Pittsberg Community

We learned in Chapter 3 that Cohonina communities cluster around hills and mountains in the piñon-juniper woodland of the Coconino Plateau. The Sitgreaves settlement system, lying east of Pittsberg is the best studied Cohonina community to date and provides an excellent basis for comparison. Samples (1992) found evidence of tiered settlement there with groups of pithouses and masonry structures, representing the basic Cohonina social unit, clustering around extra-large pithouses. These extra-large pithouses number 13 within the Sitgreaves settlement system and were presumably loci of social integration above the single household. These pithouse groups in turn cluster around two plaza sites, one of which is the largest single architectural manifestation in the settlement system. This latter site (Walavudu) is positioned near the center of the settlement system, is arguably an integrative facility, and presumably was the location for behavior that socially integrated the Sitgreaves Community as a whole.

The Pittsberg settlement system shows some evidence of tiered settlement with most habitation sites clustering on the northeast slope of Pittsberg around the Pittsberg Fort Complex. Habitation sites within the Pittsberg settlement system consist of pithouses with one or more masonry and jacal structures or single unit structures. These are in turn surrounded by a constellation of logistical sites. This pattern is very similar to that found within the Sitgreaves Settlement system. Samples (1992:134), and Cartledge (1986) before him, argued habitation sites represent individual households within a larger community. If this inference holds up, then at its highest population level during the Medicine Valley phase, the Pittsberg Community had perhaps seven households: three at Honani House (Site 2776) and one each at Sites 2774, 2786, 2779, and 2780. The Pittsberg Community differed from that at Sitgreaves Mountain in that no extra-large pit house depressions were found during the CRRP. Thus it appears intra-settlement social integration above that of the single household occurred only at the Pittsberg Fort Complex (PFC); meaning the apparent integrative functions of extra-large pithouses and plazas as separate functional units were collapsed into the PFC. Where community integration occurred before the PFC was built in the first couple of years after A.D. 1050 is unclear, but those sites classed as "ritual" for the current study hint at a possibility. Regardless, the Pittsberg settlement system represents the remains of a past community. It contains evidence of many if not all of the basic components of a functioning community. There is evidence of basic economic activity and places of daily habitation. Finally, and perhaps most importantly, the Pittbergers had their own place of social integration at the Pittsberg Fort Complex, which is to say they operated as a more or less independent social segment whose members did not have to go elsewhere to engage in integrative ritual at the supra-household level.

If the Pittsbergers were part of a more or less autonomous community, how do we define the boundaries of that community? Where did the daily social control of space for the Pittsberg Community fall off and those of other communities pick up? If Cohonina forts and their ancillary structures can be taken as a proxy for the presence of community segments on the landscape, then the Kaibab Fort (Site 0301) located about 2.75km south-southeast of the Pittsberg Fort Complex indicates another Cohonina community existed on the flanks of the next hill (Kaibab Hill) to the south of Pittsberg. The Kaibab National Forest (KNF) archaeological database indicates there is an absence of sites in the intervening flats between Kaibab Hill and Pittsberg (Figure 5.14). This empty zone might represent a social boundary between the two communities. This boundary would have been a zone on the landscape where shared notions of land tenure, access to economic resources, and freedom of travel amongst the Cohonina was wholly negotiable. The existence of an empty zone between the Pittsberg settlement system and Kaibab Hill settlement system combined with the replication of a pattern element in the form of forts hint at the location of social boundaries.

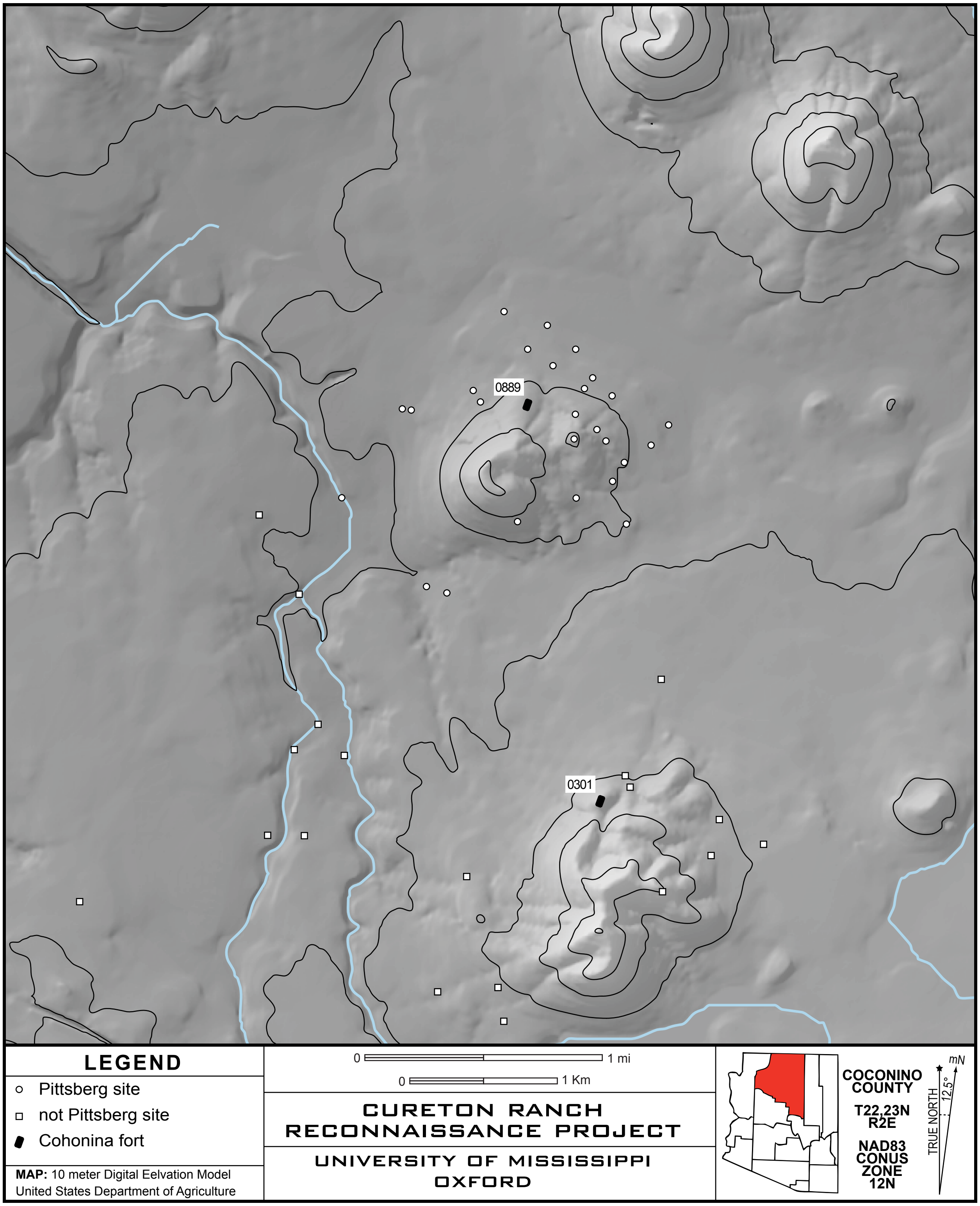

Figure 5.14. Settlement fall off between Pittsberg and Kaibab Hill settlement systems.

A similar but less apparent situation occurs to the northwest and northeast of Pittsberg. Conversations with landowners around Junipine Hill lying to the northwest of Pittsberg and a short reconnaissance by the author indicate a Cohonina community existed on the southern and eastern flanks of that hill. The 1938 MNA expedition led by Hargrave recorded a site (NA3585) in that vicinity. The Hargrave expedition also recorded two other sites on the northern slopes of the Dolly Parton Hills (NA3581 and NA3582) to the northwest of Pittsberg, suggesting a Cohonina community existed on the flanks of the Dolly Parton Hills as well. The CRRP revealed settlement fall off on the north side of Pittsberg, but a complete lack of systematic survey north of the project area hampers any effort to characterize the spatial extent of the communities around Junipine Hill and the Dolly Parton Hills.

However, if we assume the flats between Pittsberg and Dolly Parton Hills was the location of a community boundary as appears to be the case between Pittsberg and Kaibab Hill, then a partial model of the Pittsberg Community's boundary emerges. The distance between Junipine Hill and Pittsberg is far greater than those mentioned previously. Therefore we must use suitable physical boundaries as proxies for social ones in the absence of complete survey. Two small washes that empty into Cataract Creek provide such stand ins. One is a westerly running wash to the north of Pittsberg and the other is a northerly running wash to the southwest of Pittsberg. The KNF archaeological database indicate there is considerable settlement fall off west of Cataract Creek. This area to the west of Pittsberg exhibits very low site densities and the next high density cluster of sites lie on the flanks of an unnamed hill 7km to the west-southwest of Pittsberg. Thus Cataract Creek serves as a physical proxy for the Pittsberg Community's western boundary.

The elevation zone defined by the 2-sigma elevation range (1,988m to 2,100m) for Pittsberg sites is another way to model that community's boundary. This elevation range captures 96% of Pittsberg sites and maps well onto the hypothesized boundaries formed by the flats between Pittsberg, Kaibab Hill and the Dolly Parton Hills (Figure 5.15). Figure 5.16 presents a working model for the Pittsberg Community boundary. This boundary attempts to model the extent to which the Cohonina at Pittsberg exercised control of the land and resources around their

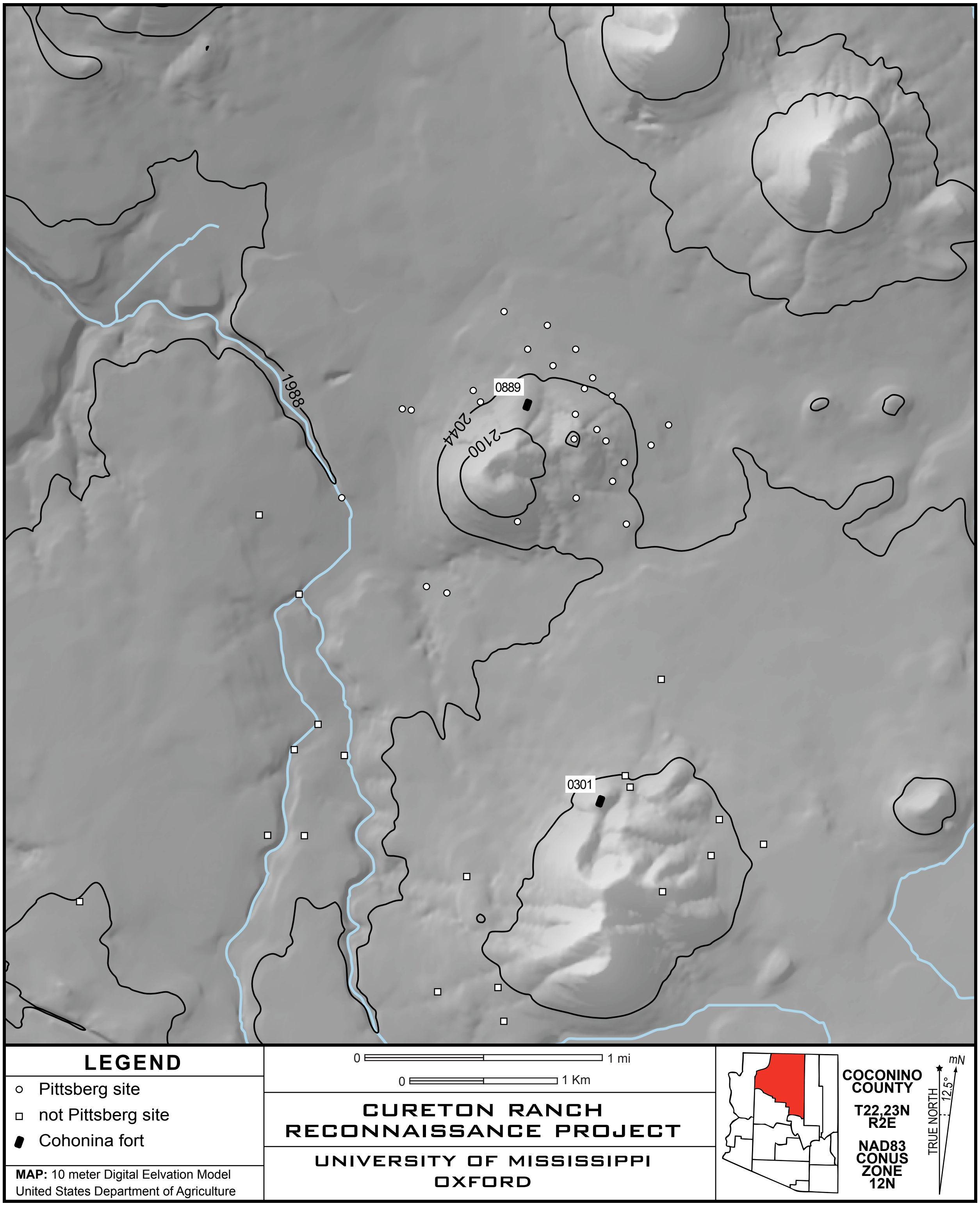

Figure 5.15. Two sigma contour lines of the Pittsberg settlement system.
(Defined by the elevation values of habitation sites within the Pittsberg settlement system)

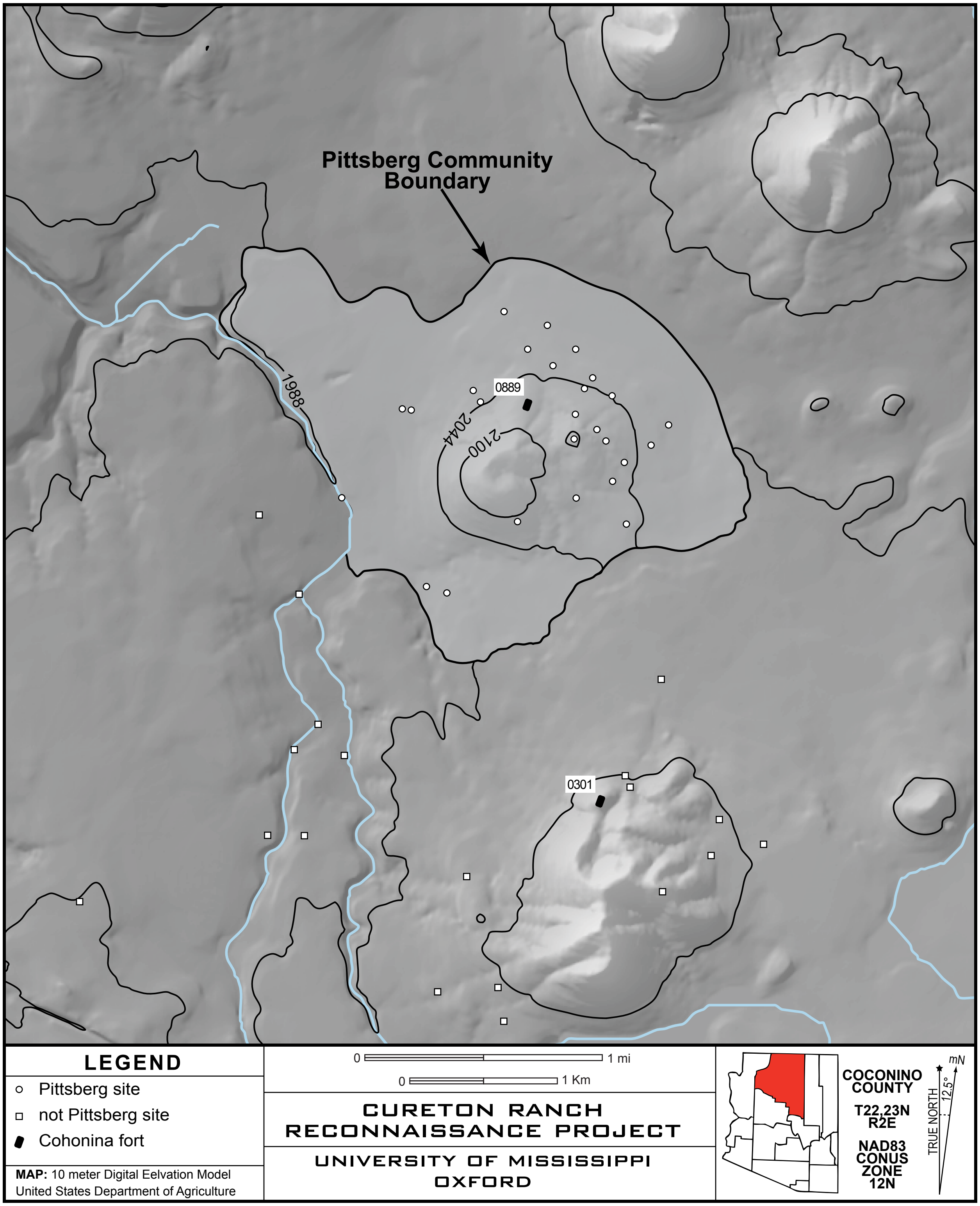

Figure 5.16. Hypothesized Pittsberg Community boundary.

community. However, this modeled boundary should not be taken to be a conspicuous and rigid division of the landscape as some international borders appear today. Rather, the social boundary it models was most likely permeable and shifting. The Pittsberg Community expanded and contracted in spatial extent and population over time which means the reach of its control in terms of land tenure or politico-economic influence probably shifted in kind. Thus the modeled boundary represents a socially noisy limen, beyond which existed a negotiated space where culturally related social segments in the form of communities articulated, interacted, cooperated and competed.

Functional Analysis of Cohonina Forts

The results of the Cureton Ranch Reconnaissance Project (CRRP) and subsequent settlement systems analysis revealed the Cohonina around Pittsberg lived in a relatively small community of perhaps seven households at its highest population level during the Medicine Valley phase. Adler (1989) used the theory of scalar stress to examine structural and functional variability of integrative facilities in contemporary non-ranked societies and the prehistoric Western Anasazi. His cross cultural comparison revealed that “within relatively small, politically nonstratified communities, integrative facilities remain generalized in use”, serving “as a context for both secular and ritual activities” (Adler 1989:35). He also found that in general, most communities that are sedentary for even a few months construct a social space intended for integrative behavior (Adler 1989:36). Because the Pittsberg Community was relatively small and because it maintained itself as a more or less discrete social segment, we can expect to find an integrative facility of some kind within its boundary. The preceding site structure analysis revealed the Pittsberg Fort Complex (Site 0889, Figure 5.17) as a built space not repeated in kind or magnitude within the settlement system; meaning it is the likeliest candidate for the Pittsberg Community’s integrative facility.

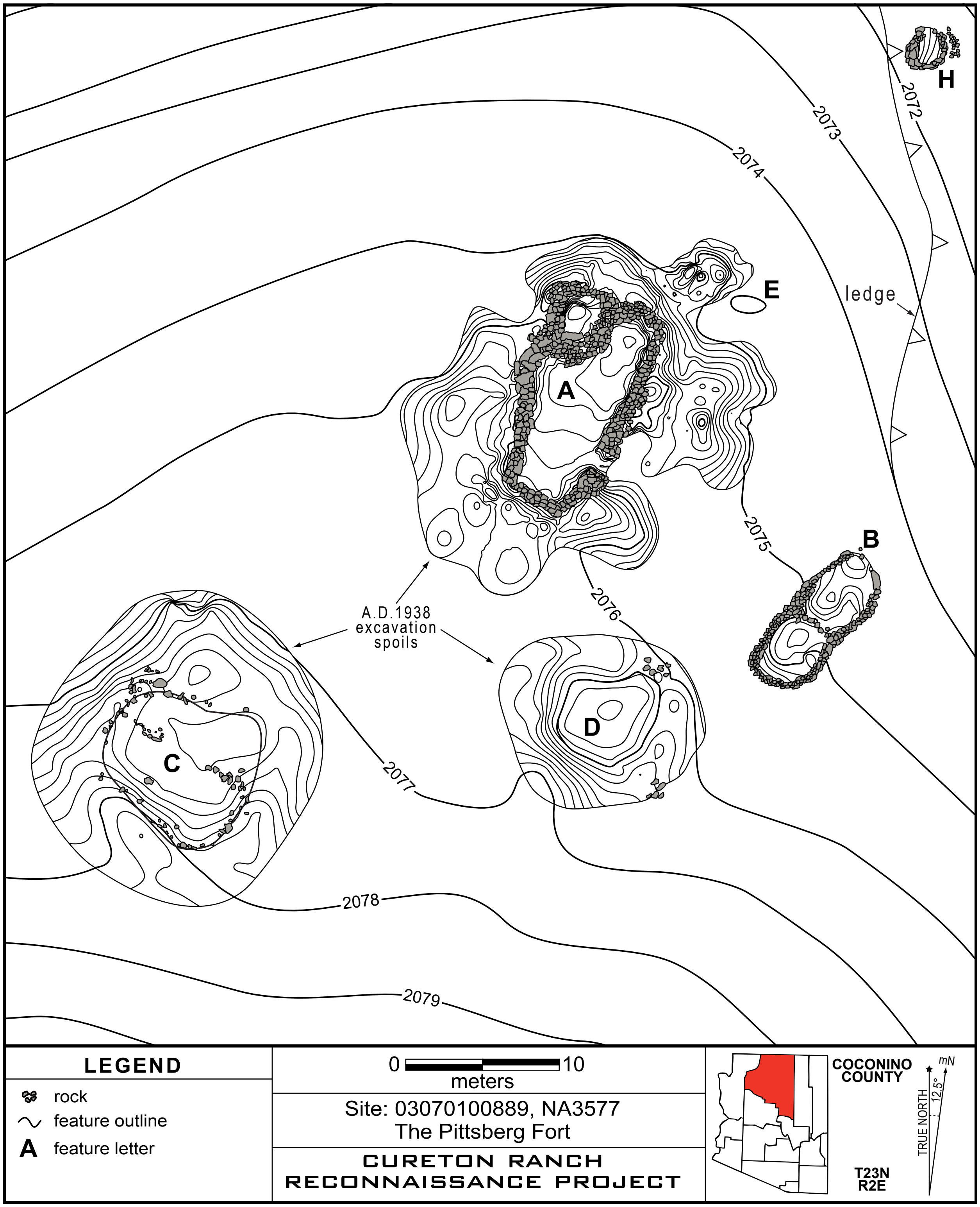

Figure 5.17. The Pittsberg Fort Complex as it appears today.

The following analyses compare the Pittsberg Fort Complex (PFC) (Figure 5.17) to three other Cohonina forts, for which excavation data exist, in an attempt to work out regularities in the sorts of behavior that went on in these contexts. The PFC consists of four large and tightly grouped structures positioned on a ridgeline of Pittsberg, upslope of Honani House. A fifth, much smaller structure is positioned downslope of the main grouping. The 1938 MNA expedition excavated Structures A though D (Hargrave 1938; MNA archives), providing a wealth of information pertaining to the gross architectural characteristics of the site as well as finer data on internal features and floor assemblages. The Medicine Fort (NA862, NA1680, NA1239; Hargrave 1933; Colton 1946; Sorrell 2005 [CCD: A.D. 1050 to 1080, MSTD: A.D. 1081 ± 42yrs.]), (Figure 5.18) consists of three large and tightly grouped structures positioned on the northeastern foothill of Medicine Crater. Medicine Cave (NA 863; Colton 1946) lies just northwest and below the main grouping at the bottom of a cliff face. Deadmans Fort (NA1765; Colton 1946 [CCD: A.D. 1065 to 1125]), (Figure 5.19) consists of a fort and a possibly related circular depression surrounded by structures dating to a later phase. The site is positioned on the northern edge of Deadman Mesa overlooking Deadman Wash. Finally, Owl Fort (NA5145; McGregor 1951 [CCD: A.D. 1050 to 1150]) (Figure 5.20) consists of a fort and longroom positioned on a low rise north of Red Butte.

Gross Architectural Characteristics

Cohonina forts have been traditionally defined as very large, exceptionally thick-walled masonry structures with a rectangular floor plan. In addition to these basic characteristics, structures identified as Cohonina forts should be roofed (Hargrave 1933; 1938) and should be in association with a long room, either attached or unattached (McGregor 1951). Beyond these basic observations the available literature does not have much to say on the gross architectural characteristics of Cohonina forts.

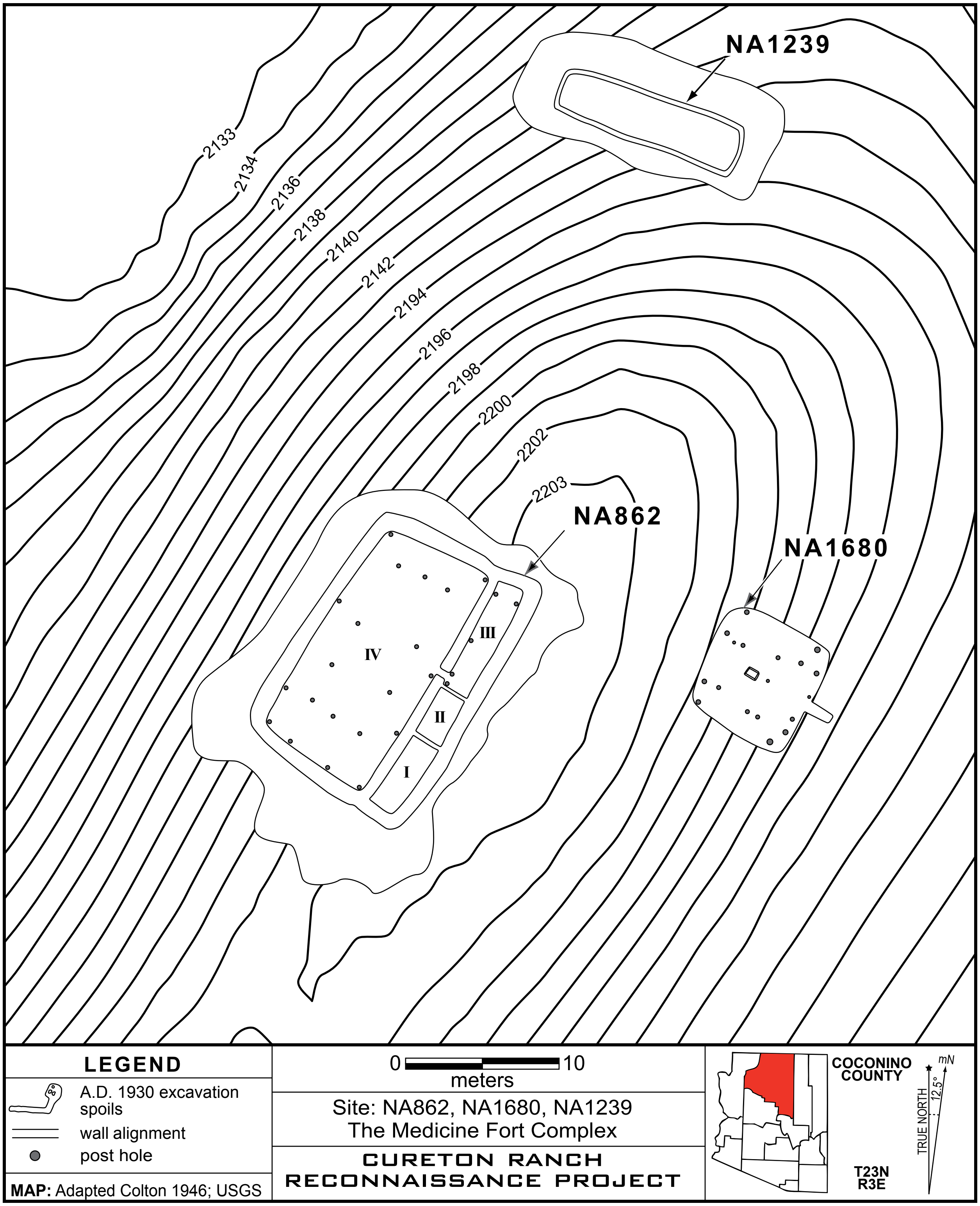

Figure 5.18. The Medicine Fort Complex.

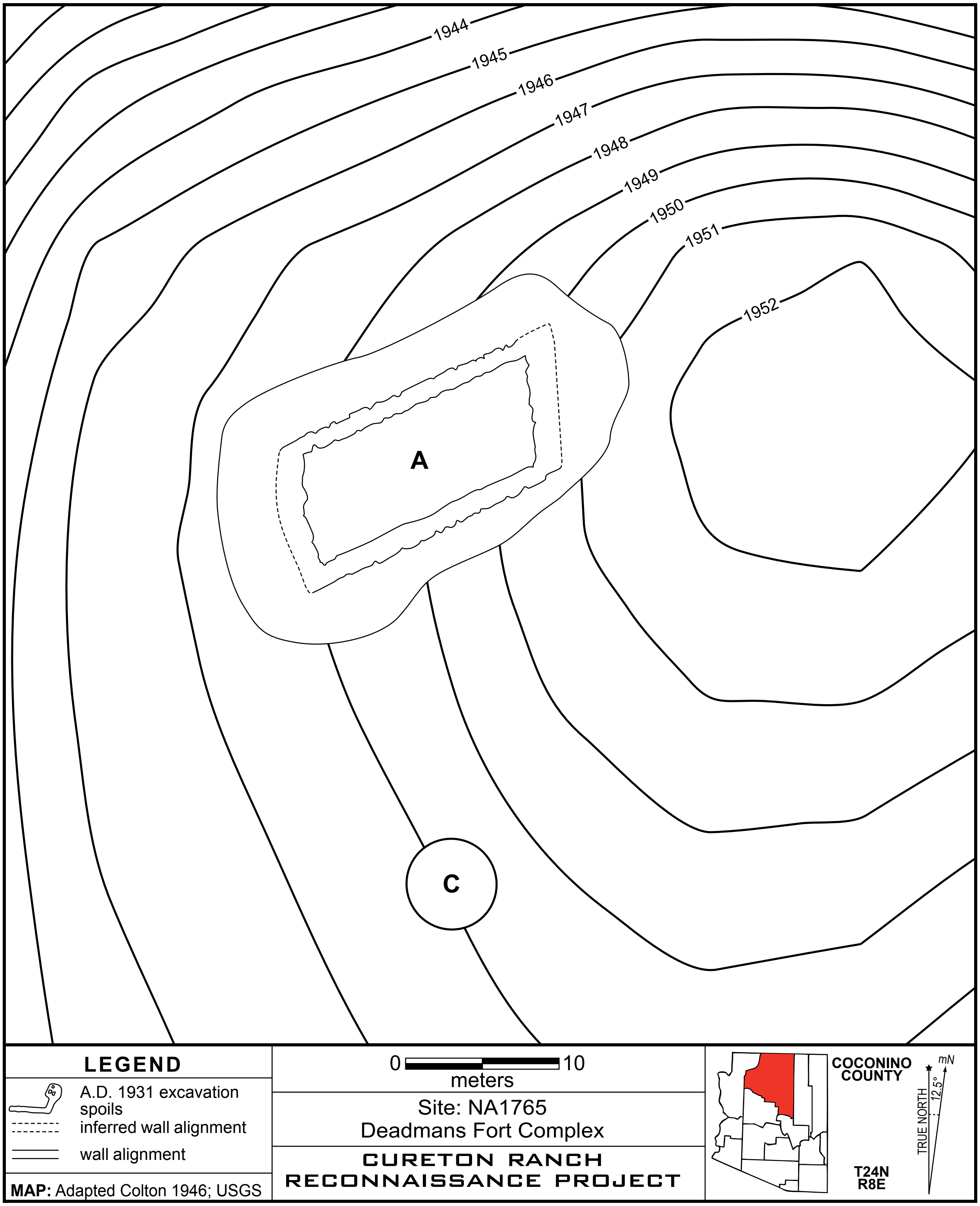

Figure 5.19. The Deadmans Fort Complex.

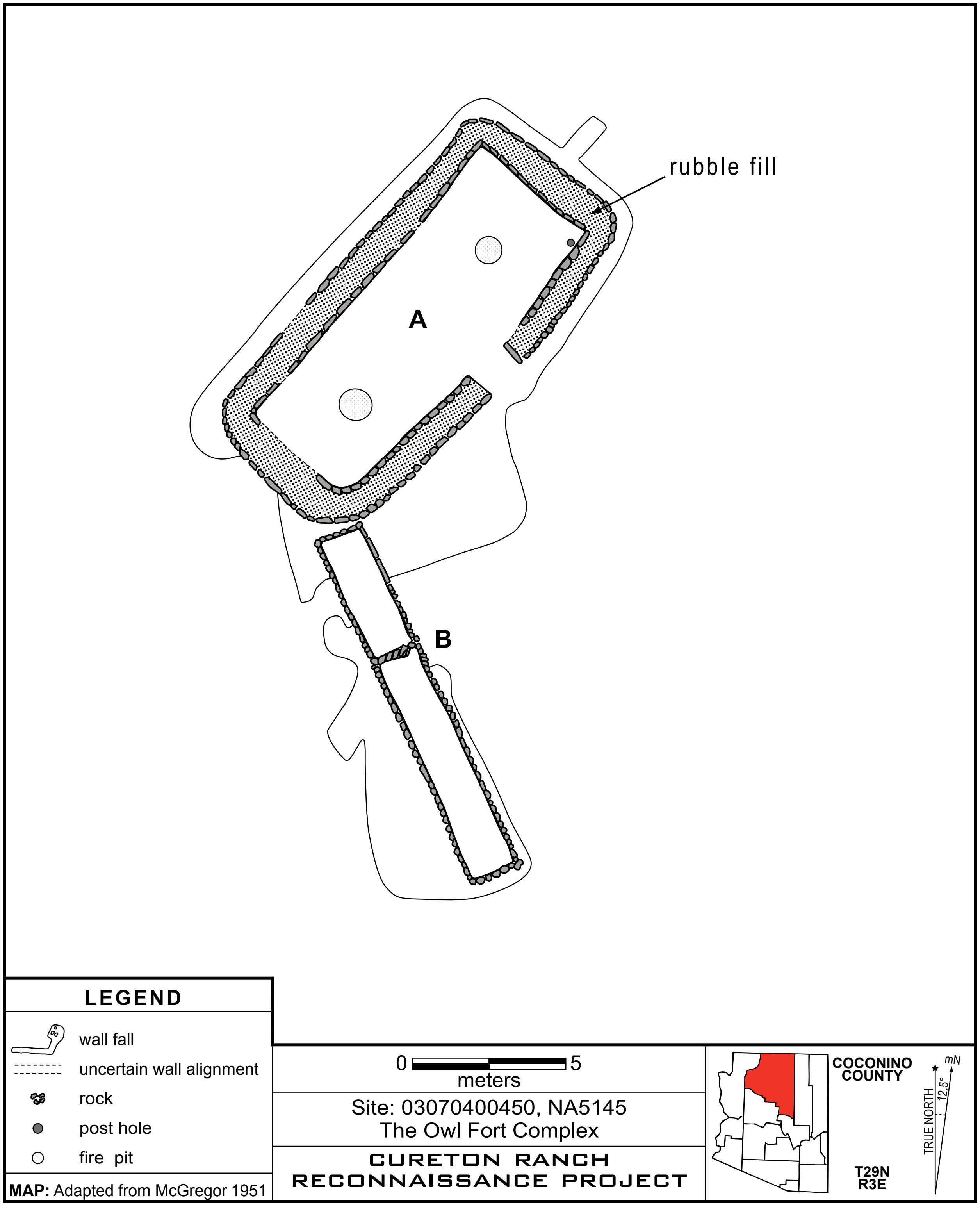

Figure 5.20. The Owl Fort Complex.

Turning our attention to the available data on excavated forts, the immediate conclusion is that Cohonina forts never occur in isolation and do in fact have uniquely thick walls. They also tend to have their long axis oriented several degrees east of north as well as having a single doorway positioned on their east sides. Exceptionally walls are the most consistent architectural feature of forts and thus deserve further comment. Excavated structures inferred to have a domiciliary or storage function (McGregor 1951, 1967a, Samples 1992) all have wall thicknesses on the order of 20 to 30cm, while fort walls are often a meter or more thick. The dominant method of fort wall construction involved setting relatively flat beds of rubble in mud mortar; sometimes utilizing rather large boulders a meter on a side. The Owl Fort presents an unusual deviation from the norm in that its builders utilized a leaf and rubble fill method of construction (McGregor 1951:75). Large sandstone slabs and limestone boulders were set on-end to form the interior and exterior leaves of the walls. The builders then used Dirt and cobbles to fill the intervening space. The amount labor required to raise fort walls, regardless of specific construction method, to the conservative height estimate of two meters undoubtedly far and away outpaced that required to do the same for the much smaller domicile class of Cohonina architecture. This is an important point because it indicates fort construction required the mobilization of labor beyond the single household; meaning the construction of forts and their ancillary structures were community projects.

McGregor (1951) was the first to catch on to the notion that forts never occur in isolation when he saw the connection between that architectural class and longrooms. The narrow dimensions of the latter features suggest they were not meant to house people, leading researchers from a very early period (Hargrave 1933) to infer a storage function for similar structures. We can also extend fort associations to pit structures and other surface masonry rooms. At the PFC the fort is associated with a masonry and jacal structure (Structure C) and a deep pithouse (Structure D) in addition to a longroom (Structure B). Structure C is something akin to an extra large version of Cartledge's shallow pit house architectural class, while Structure D is not out of the size range for the excavated diameter of Samples' (1992) extra-large pithouse class.

A similar situation exists at Medicine Fort (NA862) despite an entrenched habit of talking about that fort as if it were a lone structure on a hill. Medicine Pithouse (NA1680), an extra-large pithouse, lies approximately 14m east of the fort and it is altogether unclear why Museum of Northern Arizona (MNA) staff assigned it a separate site number. A longroom (NA1239) is also present at the Medicine Fort site, lying about 30m to the north of the fort. Finally, Medicine Cave (NA863) is located immediately below and to the west of the fort at the base of a cliff. Deadman's Fort (1765A) is harder to understand in terms of associated structures because two distinct temporal components are present at that site. Structure A (the fort) of site NA1765 (CCD of A.D. 1065 to 1125) is likely contemporaneous with a pit structure (Structure C), while NA1764A, B, C, D, and NA1765B all belong to a later time period after A.D. 1175 (Downum 1988). McGregor (1951) found the Owl Fort in association with a longroom positioned at an angle to the fort proper. KNF site files indicate Site 03070400450 is the Owl Fort Complex and a recent site visit by KNF archaeologists indicate at least one additional structure is associated with the fort and longroom (Weintraub 2013, personal communication). Bone's (2002:115, Table 5.1) analysis of Cohonina forts also indicate that forts are not likely to occur in isolation with 88% of fort sites (excluding two sites, see below) having more than one habitable structure. The foregoing data suggest that Cohonina fort sites should be thought of as complexes of structures, not as isolated buildings. This of course has been known since the early 1950s (McGregor 1951), but it nevertheless seems necessary to reiterate that fact.

Bone (2002) compared the area enclosed by Cohonina public architecture in an attempt to measure differences between Coconino Plateau subregions in terms of the numbers of people that could have participated in integrative ritual within those structures at any one time. He included ten fort sites in that analysis, however upon reexamination, two of those sites (Sites 0018 and 1200) cannot be classed as Cohonina forts because they lack a large rectangular and exceptionally thick walled structure. These sites are more akin to "lookouts" or "relays" described by Wilcox and colleagues (2001). Only one of the sites included in the current study, the PFC, is included in Bone's dataset. However, Bone's area calculations for the PFC differ from those

I calculated. Bone reported the enclosed area defined by the largest structure (presumably the fort) as 80m^2 and the total enclosed area defined by all structures at the site as 167m^2. When I calculated enclosed areas for the PFC in ArcGIS based on updated feature outlines derived from CRRP remapping and digitized field maps from the 1938 expedition, I arrived at an enclosed area of 67m^2 for the fort and 163m^2 for the area enclosed by all structures. The cause of these discrepancies is unclear because Bone did not describe the specifics of how he arrived at area calculations.

I compiled Bone's data, minus Sites 0018 and 1200, with my area calculations from the four forts currently under consideration (Tables 5.13 and 5.14). The results indicate there is considerable variation in the amount of enclosed space at fort sites generally and fort features specifically (Figure 5.21). The coefficient of variation in the sample of fort features is 63.98% and that of fort sites as a whole is 60.32%. The distribution of area values for both categories also indicates there are outliers. Two outliers exist in the forts only data: Elk Fort and Pumpkin Fort. The very small enclosed area of Pumpkin Fort (20m^2) relative to the mean (153.18m^2) suggests that it might not be a fort at all, or the calculation is in error. Similarly, the very large enclosed area of Elk Fort (375m^2) could mean it is a different class of integrative facility; a plaza for instance. When these outliers are removed from consideration the coefficient of variation drops to 41.4%. The coefficient of variation in the sample of fort sites as a whole (60.32%) reflects a similar situation. Three outliers are present in that data. The Pumpkin Fort Complex again encloses very little space, as does the Owl Fort Complex. The small total enclosed area for the former complex is likely attributable to the very small size of its alleged fort, while the latter's fort is not remarkably small, but the complex as whole exhibits only two structures. However, the structure count at the Owl Fort Complex is off (see above). The Piñon Nut Fort Complex reveals itself as enclosing a remarkably large total enclosed area (585m^2) relative to the mean. There are five large structures at the site which might reflect the group size that built and used the Piñon Nut Complex, but it could also mean the site belongs to the generally larger plaza class of

Table 5.13. Enclosed space at fort sites by individual structure.

Site Number	Site Name	Structure	Total Enclosed Room Space
03070100889	Pittsberg Fort Complex	A	67m²
03070100889	Pittsberg Fort Complex	B	21m²
03070100889	Pittsberg Fort Complex	C	35m²
03070100889	Pittsberg Fort Complex	D	39m²
NA862	Medicine Fort Complex	A	157m²
NA862	Medicine Fort Complex	B	56m²
NA862	Medicine Fort Complex	C	33m²
NA1765	Deadman's Fort Complex	A	109m²
NA1765	Deadman's Fort Complex	C	27m²
03070400450	Owl Fort Complex	A	51m²
03070400450	Owl Fort Complex	B	17m²
03070100301	Kaibab Fort Complex	A	192m²
03070100301	Kaibab Fort Complex	B	49m²
03070100584	Dutch Kid Fort	A	165m²
03070100584	Dutch Kid Fort	B	-
03070100584	Dutch Kid Fort	C	-
03070200132	Twin Fort	A	161m²
03070200132	Twin Fort	B	-
03070200132	Twin Fort	C	-
03070200132	Twin Fort	D	-
03070200706	Red Hill Fort	A	240m²
03070200708	Elk Fort	A	375m²
03070200708	Elk Fort	B	-
03070200708	Elk Fort	C	-
03070200804	Pumpkin Fort	A	20m²
03070200804	Pumpkin Fort	B	-
03070200804	Pumpkin Fort	C	-
03070200804	Pumpkin Fort	D	-
03070200804	Pumpkin Fort	E	-
03070200804	Pumpkin Fort	F	-
03070200804	Pumpkin Fort	G	-
03070200804	Pumpkin Fort	H	-
03070200804	Pumpkin Fort	I	-
03070201385	Piñon Nut Fort	A	148m²
03070201385	Piñon Nut Fort	B	-
03070201385	Piñon Nut Fort	C	-
03070201385	Piñon Nut Fort	D	-
03070201385	Piñon Nut Fort	E	-

Table 5.14. Total amount of enclosed space at fort sites.

Site Number	Site Name	Total Enclosed Space
03070100889	Pittsberg Fort Complex	163m²
NA862	Medicine Fort Complex	246m²
NA1765	Deadman's Fort Complex	136m²
03070400450	Owl Fort Complex	67m²
03070100301	Kaibab Fort Complex	241m²
03070100584	Dutch Kid Fort	290m²
03070200132	Twin Fort	342m²
03070200706	Red Hill Fort	240m²
03070200708	Elk Fort	391m²
03070200804	Pumpkin Fort	66m²
03070201385	Piñon Nut Fort	585m²

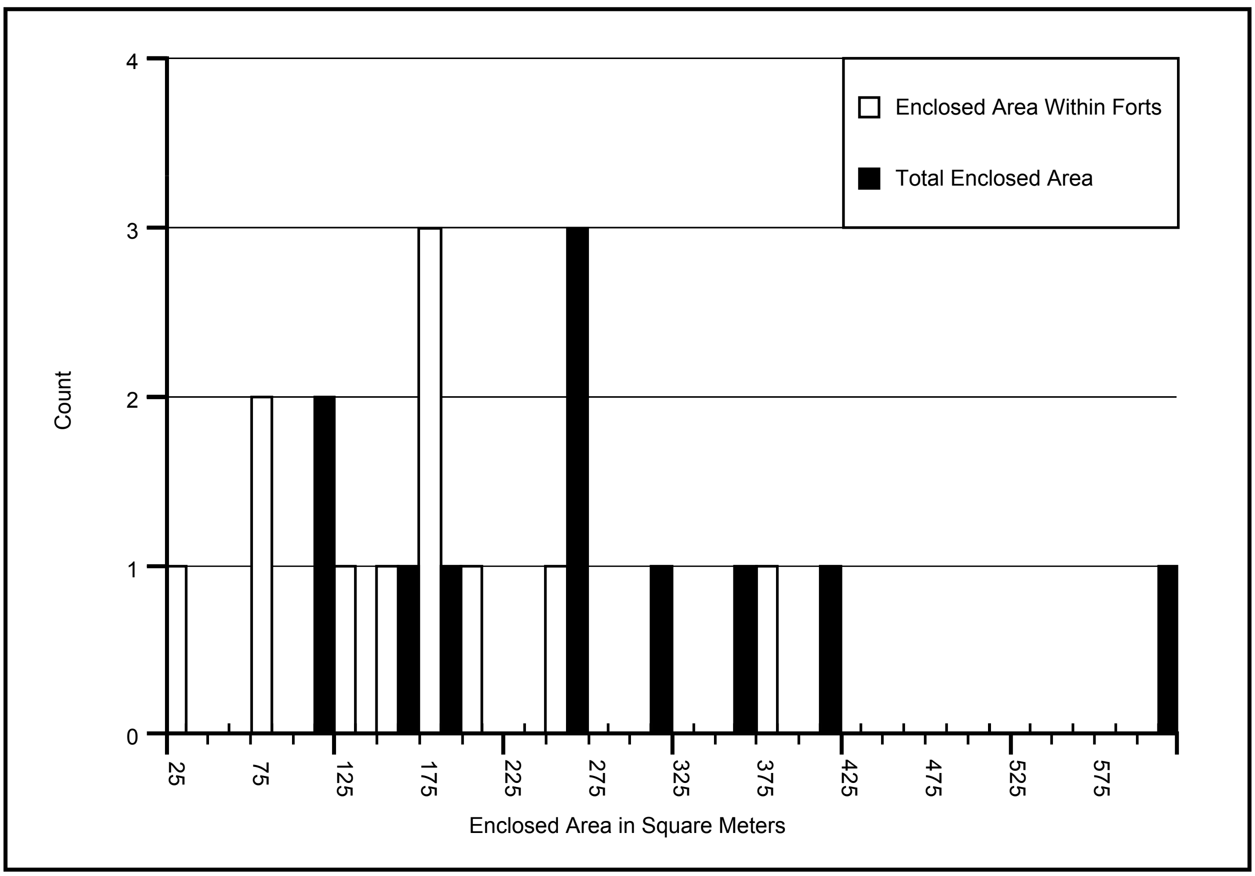

Figure 5.21. Distribution of enclosed space values for forts and fort sites as a whole.

public architecture. When these outlier values are removed the coefficient of variation drops to 33.13%.

Adler (1989) applied scalar stress theory to a comparison of community and use-group size to the total area enclosed by public architecture for an ethnographic sample. He argued that as the size of the social group that is the basic decision making entity (the basal unit) increases, so should the size of integrative structures (Adler 1989:41). This expected positive relationship between integrative structure size (measured in square meters), and basal unit size is borne out in his ethnographic sample (Adler 1989:42-43). When the mean total enclosed space at fort sites (minus outliers) is compared with Adler's ethnographic information, it coincides with a use group size, or the size of the group most intimately associated with integrative facility use, of about 202 persons. When the enclosed space of only forts (minus outliers) is compared with Adler's data, it coincides with a use group of about 117 persons. The total enclosed space of the Pittsberg Fort Complex coincides with a use group of about 132 persons whereas the total enclosed space of the fort only indicates a use group size of about 61. The latter figure fits best with a population estimate for the Pittsberg Community during the Medicine Valley phase. The Pittsberg Community had perhaps seven households during the Medicine Valley phase and if we assume a household size range between 5 and 8 persons (Doelle 2000; Elson 2011), we arrive at a population estimate between 35 and 56 individuals for the community as a whole. The results very tentatively hint at the use group size of fort complexes as well as a possible correlation between community size and the size of the space enclosed by forts. However, it cannot be stressed enough these are "back of the napkin" calculations and the business of paleodemography is fraught with pitfalls (Nelson et al. 1994; Frankberg and Konigsberg 2006).

Floor Assemblages and the Use of Space

The exceptional effort required to raise fort complexes relative to other Cohonina architectural classes suggest they were public edifices and gross architectural similarities between fort complexes suggest a similar primary function for these sites, although the use-group size may have varied. However, these data do not reveal the specific behaviors that went on at these places. Adler's (1989) cross cultural investigation of integrative facilities also found regularities between community size and the degree to which behavior at integrative facilities fits a general use pattern; meaning both ritual and secular activities occur within public architecture. He found that in small communities, numbering no more than 150 to 175 individuals, integrative facilities are the locus of ritual integrative behavior as often as mundane behavior such as preparing and eating food or craft production. In light of this pattern and my tentative use group estimates for fort complexes, we can expect to find a range of activities at these facilities.

Floor artifact and feature assemblages provide a means to explore the kinds of ritual and/or secular behaviors that occurred within forts complexes (Varien and Lightfoot 1989). I reconstructed floor feature and floor artifact assemblages at the Pittsberg Fort Complex (PFC) based on Museum of Northern Arizona (MNA) artifact inventories and plan maps prepared during the site's excavation in the summer of 1938 (Figures 5.22, 23, 24). However, there are gaps in this dataset, making it impossible at this point to plot all of the artifacts within each structure, which results in underestimates of artifact counts. This problem is particularly pronounced when it comes to ceramic vessels. Intact vessels were rare at the PFC and the MNA inventory only lists "Lot" specimens of ceramic artifacts without any indication of how many or what kind of sherds are present in each lot, although McGregor (1951:31) lists a ceramic count of 6,863 sherds for the site as a whole. Thus vessel estimates grossly underestimate the actual number of vessels present. I was able to reconstruct floor assemblages for Structures A, C, and D in descending order of completeness. The 1938 field notes and MNA inventory for Structure B are too incomplete to confidently reconstruct its floor assemblage. Enough information exists to reconstruct the type and position of internal floor features within Structures A and C. Floor plan maps of Structure B do not exist to the author's knowledge. The poor preservation of Structure C's floor prevented its excavators from building a complete floor plan map. I did not reconstruct floor artifact assemblages for the Medicine, Deadman's and Owl Fort Complexes, relying instead on

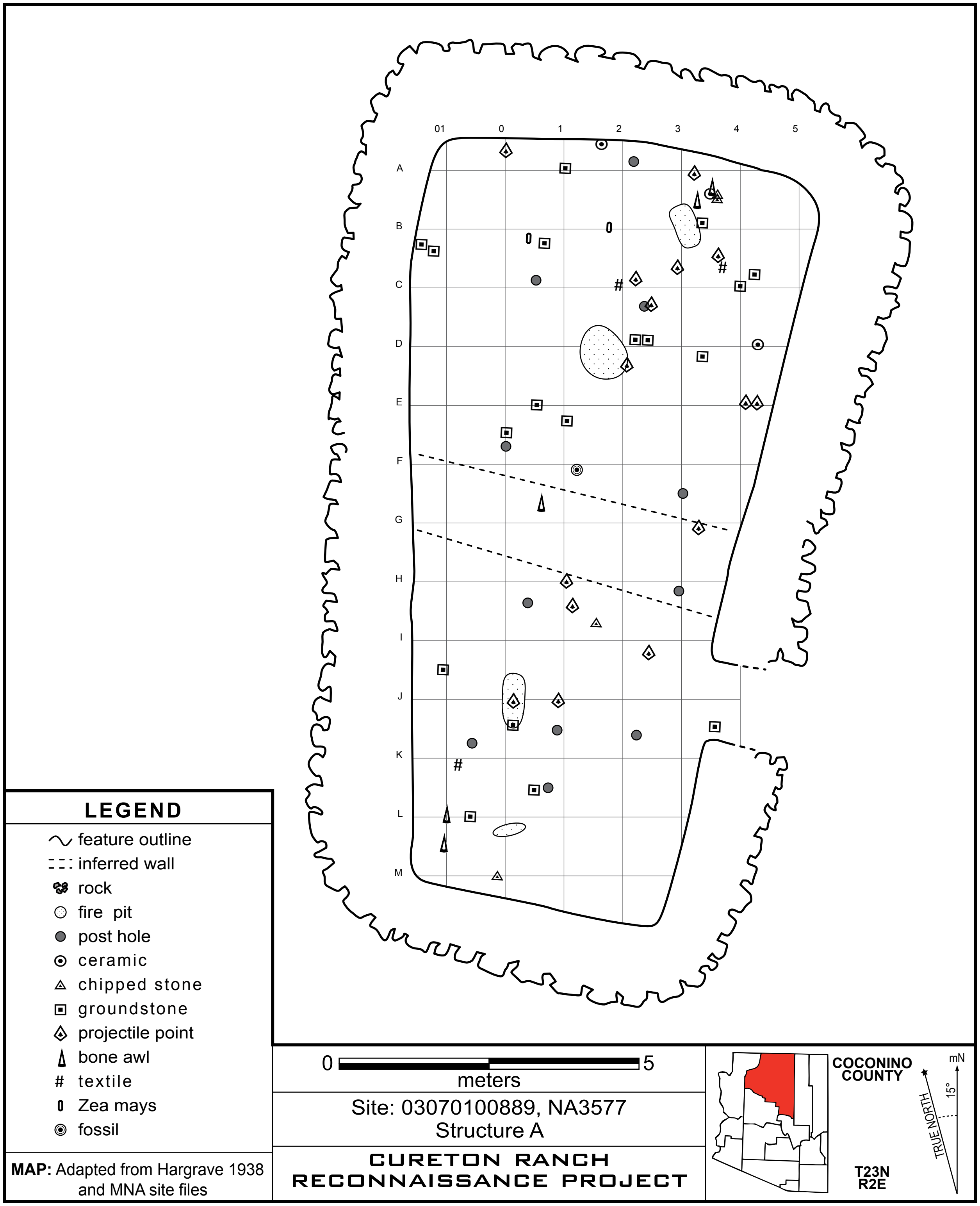

Figure 5.22. Structure A (fort) floor feature and artifact assemblage.

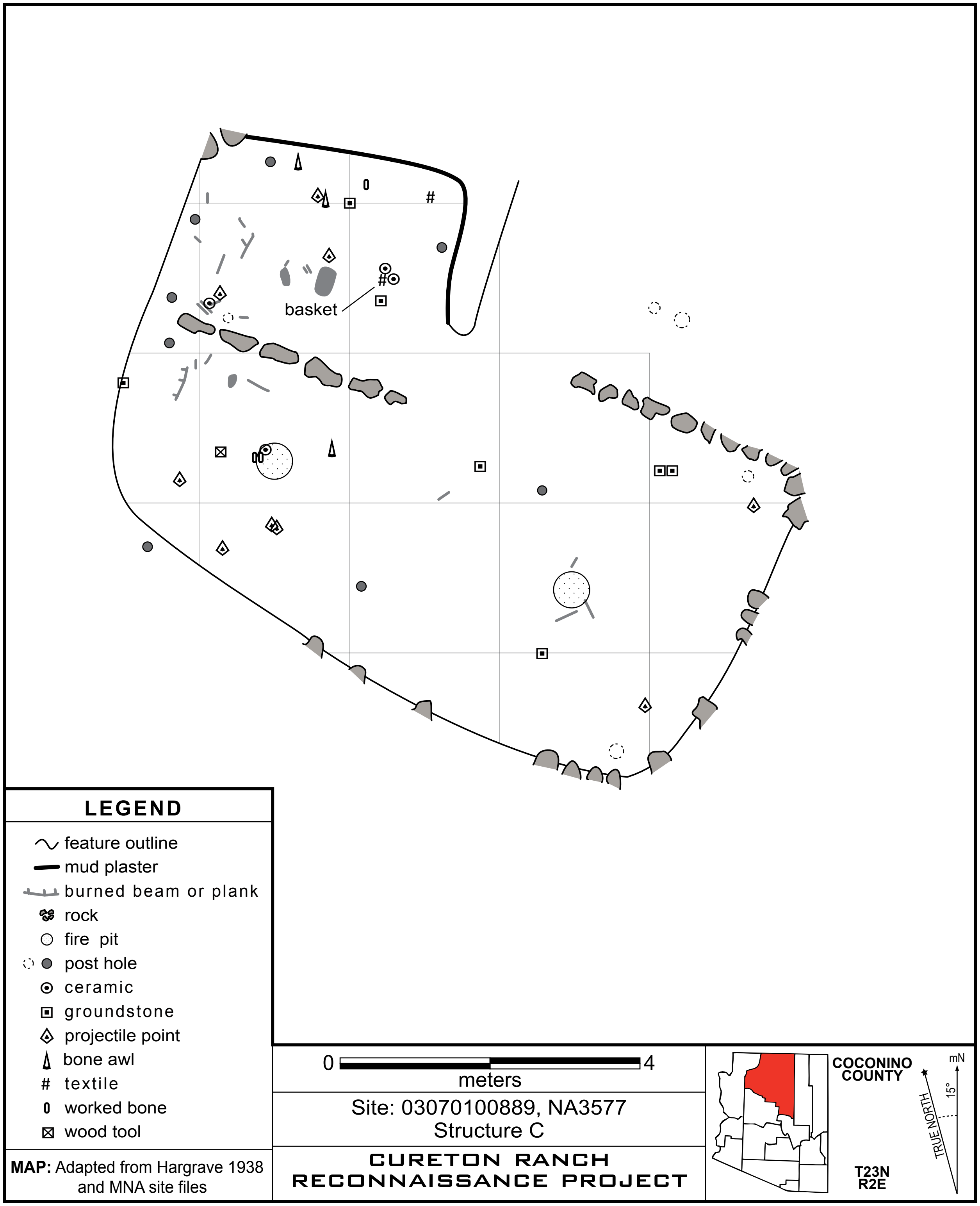

Figure 5.23. Structure C floor feature and artifact assemblage.

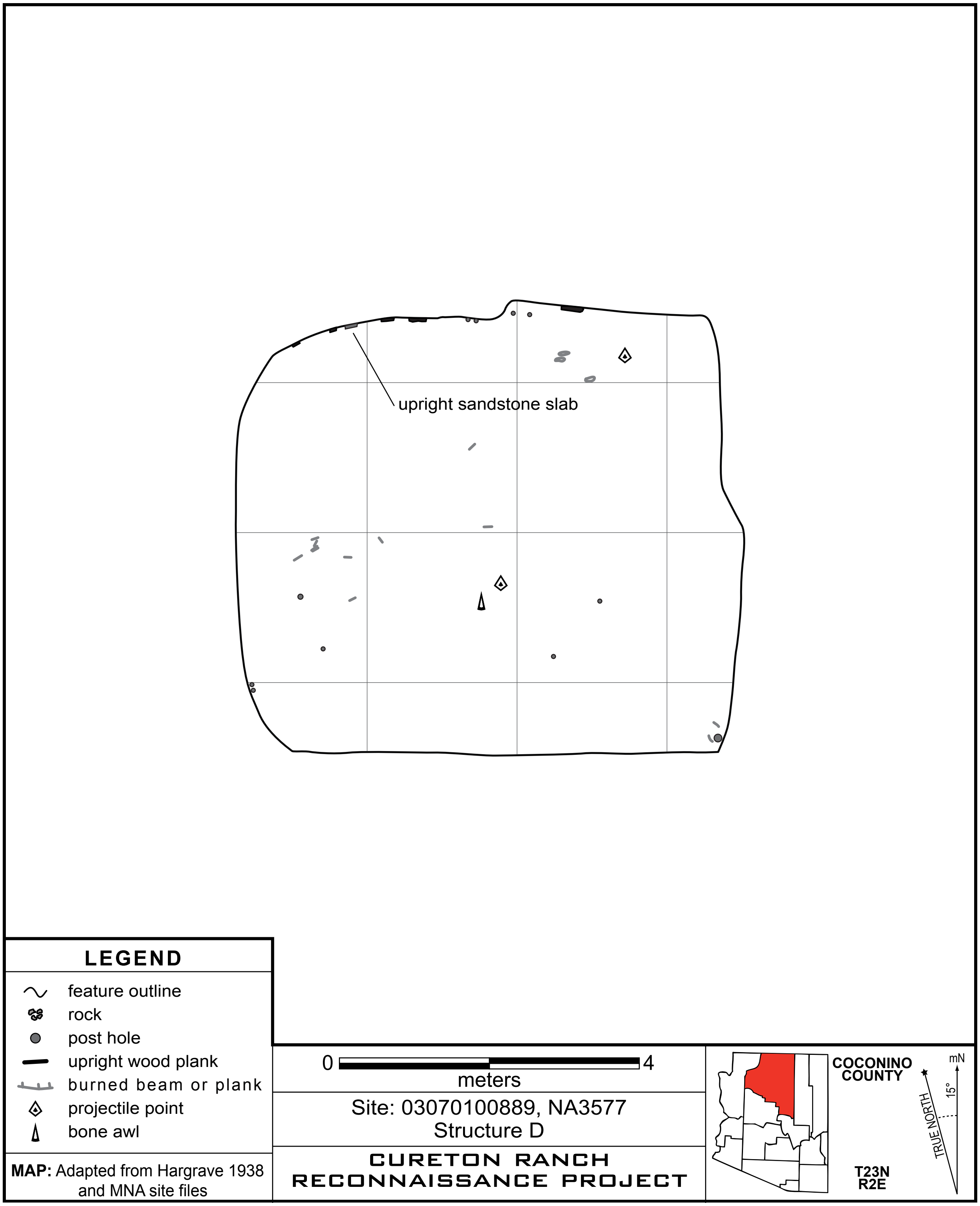

Figure 5.24. Structure C floor feature and artifact assemblage.

counts from MNA inventories and other sources of information (Hargrave 1933; Colton 1946; McGregor 1951; Downum 1988).

Deadman's Fort Complex and the Owl Fort Complex necessitate special considerations. Deadman's Fort was only partially excavated; meaning its artifact inventory greatly underestimates the actual floor assemblage. The Owl Fort Complex on the other hand presents a peculiar situation wherein its builders may have not completed the structure before it was abandoned. The fort's southern wall was missing its interior leaf and McGregor (1951:77) mentions large sandstone slabs resting within the structure which he suspected were awaiting placement into the southern wall. He also noted only one posthole in the fort's northeast corner adding to his suspicion the structure lay in an unfinished state. McGregor also estimated the full wall height at 1 to 1.5m at the time of abandonment which is somewhat shy of estimates for Medicine and Pittsberg Fort. Finally, McGregor (1951) lists a very small number of non-ceramic artifacts (26) and ceramic sherds (342) for the site as a whole, further highlighting the unusual nature of the Owl Fort Complex relative to the other excavated fort sites. Taken together, the evidence suggests floor assemblages at the Owl Fort and Deadman's Fort Complexes should be approached with caution.

Hearths are the only internal features consistently present in Cohonina forts besides post holes. Other internal features include pot rests at the Pittsberg Fort and two instances of dividing walls and a storage pit at Medicine Fort. Hargrave (1933) reported on the presence of three "ash areas" positioned in the middle of Medicine Fort, but these are not included in the floor plan map presented by Colton (1946). Pittsberg Fort exhibits four areas variously referred to as "ash areas" or "fire pits" (Hargrave 1938; MNA archives) split into groups of two positioned at either end of the building. However, there is some indication only two of these were in use at the time the fort was destroyed by fire (Downum 1988). Finally, McGregor (1951) reports the Owl Fort had two "ash areas" positioned at either end of the fort. The data suggest the Cohonina tended to maintain two fires positioned at either end of their forts and these were apparently built directly on the floor. Photographs taken during the excavation of the Pittsberg Fort indicate there were at least four shallow depressions in the floor of that structure which supported large storage vessels. Similar features are not reported for either Medicine Fort or Owl Fort.

Museum of Northern Arizona archives list 472 artifact specimens for the Pittsberg Fort Complex. One hundred and twenty of these come from Structure A, 12 from Structure B, 50 from Structure C, 18 from Structure D, and 25 specimens came from miscellaneous contexts. There are also 229 ceramic lots, 14 lithic lots, 2 lithic or groundstone lots, 1 groundstone lot, and 1 paint minerals lot. The proveniences of these latter items are not readily known without inspecting each specimen. Most specimens originating from structure contexts were readily assignable to 22 separate artifact classes (Table 5.15). In order to examine variation in the kinds of

Table 5.15. Inventory of artifacts recovered from the Pittsberg Fort Complex.

	Structure A		**Structure B**		**Structure C**		**Structure D**		**Total**
Provenience	**Floor**	**Any**	**Floor**	**Any**	**Floor**	**Any**	**Floor**	**Any**	**Site**
Axe	1	1	-	-	-	-	-	-	1
Basket	-	-	-	-	1	1	-	-	1
Bead	1	2	-	-	-	-	-	-	2
Bone Awl	9	11	1	1	3	3	1	1	16
Bowl	2+	2+	-	-	-	-	-	-	2+
Ceramic Disc	3	7	-	-	2	2	1	2	9
Cordage	2	3	-	-	-	-	-	-	3
Drill	-	1	-	-	-	-	-	-	1
Fabric	-	-	-	-	1	1	-	-	1
Food Item	2	2	-	-	2	2	-	-	4
Jar	6+	6+	-	-	1+	1+	1	1	8+
Manuport	1	1	-	-	-	-	-	-	1
Mano	12	12	-	-	-	-	-	-	12
Metate	5	5	-	-	3	5	-	-	10
Polishing Pebble	-	-	-	-	1	1	-	-	1
Projectile Point	23	36	2	3	10	10	2	4	53
Perforated Ceramic Disc	2	2	-	-	-	-	-	-	2
Stone Cylinder	-	-	-	-	3	4	-	-	4
Tool, Bone	1	1	2	2	3	3	-	-	6
Tool, Ceramic	1	1	-	-	-	-	-	-	1
Tool, Chipped Stone	2	2	-	-	1	1	-	2	5
Tool, Wood	-	-	-	-	1	1	-	-	1

behaviors these artifact classes represent I collapsed them into eight broad functional categories supported by corresponding literature for each designation (Table 5.16).

The “non-Economic or Ritual Behavior” functional class deserves some explanation. The artifact class “bone awls” supposes an economic function for these items. However, the presence of bone awls in two male Cohonina burials (Cartledge 1986), and the lack of use wear consistent with their use for perforating materials has led some (Cartledge 1986; Rice and Watkins 2009) to argue many bone awls are actually hairpins or served both functions simultaneously. When these observations are combined with the high frequency of these items at the PFC (16) relative to other Cohonina contexts (McGregor 1951, 1967a) it suggests these items were being used for something other than economic output. Projectile points present a similar situation to bone awls. Projectile points can simultaneously represent hunting endeavors (Ellis 1997), warfare (Ellis 1997; Rice and LeBlanc 2000), ritual paraphernalia (McGregor 1943; Rice and Watkins 2009), or items of personal adornment (Haury 1950:290, Plate 21). Again, when the preceding information is combined with the uncannily high incidence of projectile points at the PFC (53) relative to other Cohonina contexts (Bair and Stoker 1993) it appears their use at the PFC was non-economic. Ceramic discs may have been game pieces or hunting paraphernalia (Mills et al. 1993). Stone cylinders and discs are thought to have had a ritual function, although the former may have

Table 5.16. Functional classes and applicable references used during analysis.

Functional Class	Defining Artifact Classes	Reference
Ceramic Production	Polishing Pebbles and Ceramic Tools	Adams 2002; Mills et al. 1993
Food Processing	Manos and Metates	Adams 2002
Food Storage	Jars, Baskets, Food Items	Hargrave 1933; Colton 1946
Food Consumption	Bowls	Mills 2007
General Work	Any non-Specific Tool, Axes, and Drills	
Yarn Production	Perforated Ceramic Discs	Neff 1996
Hunting, Warfare, Ritual, and Adornment	Projectile Points	Haury 1950; Ellis 1997; Rice and LeBlanc 2000; Rice and Watkins 2009
non-Economic or Ritual Behavior	Bone Awls, Ceramic Discs, Stone Discs, Manuports, Projectile Points, Stone Cylinders, Adornments, Fetishes, Pigments, Pipes, Boxes	Mills et al. 1993; Adams 2002; Rice and Watkins 2009

been involved in pottery manufacture (Adams 2002). Ritual functions are inferred for pigments, fetishes, pipes, and boxes (McGregor 1943; Colton 1946). The sole manuport at the PFC was collected from Structure A (the fort) and consisted of a crinoid fossil. Fossils are almost always recovered from ritual contexts such as burials in prehistoric Southwestern sites (e.g. Reid and Whittlesey 1999) and Cushing (1979:194-212) observed that amongst the Zuni fossilized animals carried immense magical power. Lastly, I classed bracelets, beads, and pendants as items of personal adornment.

Three general patterns in the data reveal themselves in Figure 5.25. First, the majority of artifacts at the Pittsberg Fort Complex (PFC) are concentrated in Structure A, the fort. Second, this distribution does not change appreciably when one considers floor assemblages alone or

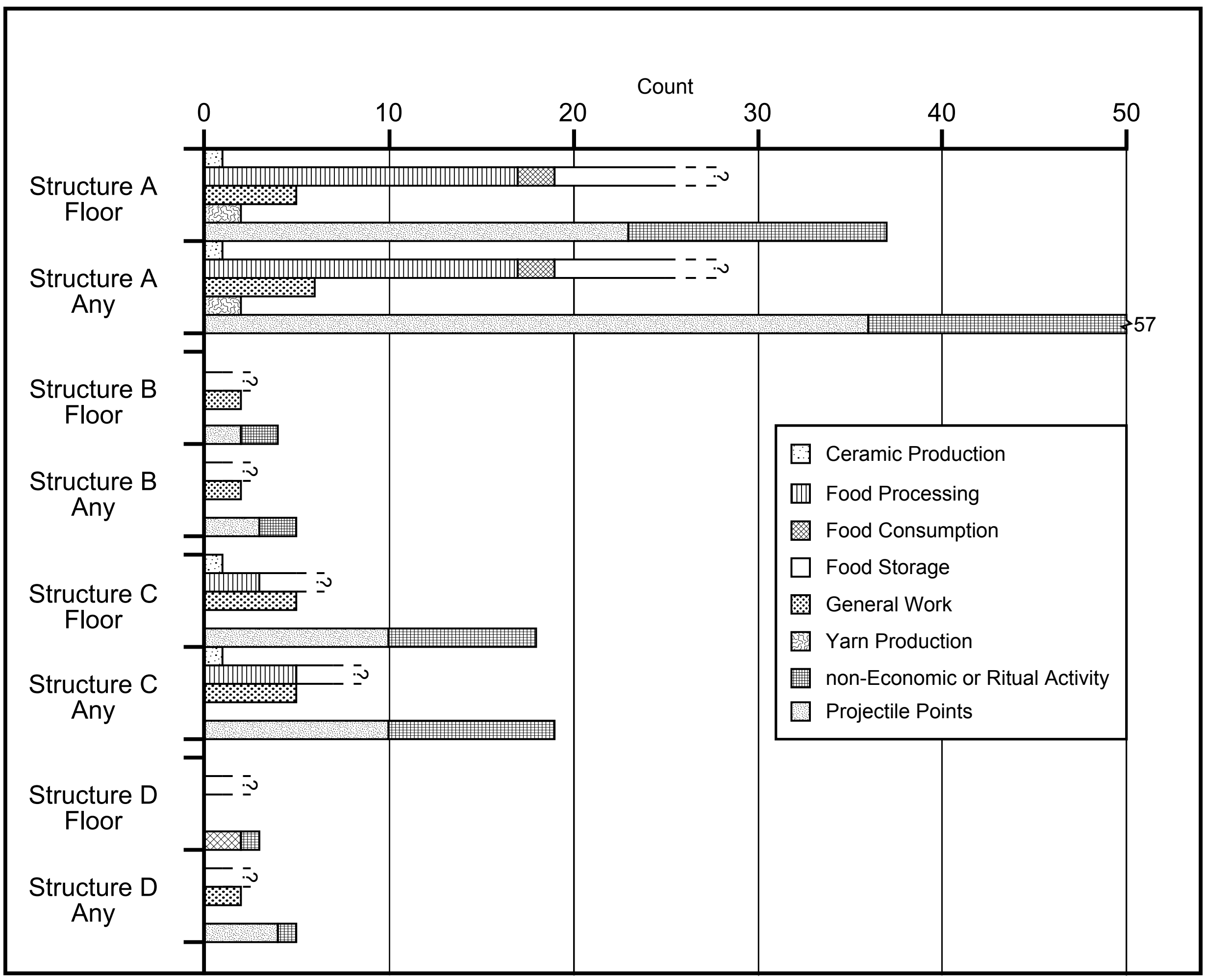

Figure 5.25. Distribution of artifacts at the Pittsberg Fort Complex.

the assemblages of entire structures as a whole. Structures B and D present very little material, while Structure C contains a modest percentage of those items related to non-economic or ritual activities. Third, a range of activities occurred within each structure, but it was Structures A and C that exhibit the greatest variation and intensity of those activities. There is some evidence of ceramic manufacturing and yarn production at the PFC. A handful of formal tools made of chipped or ground stone, bone, and wood support the idea of fort complexes as contexts of multiple secular activities. However, debitage from chipped or ground stone tool manufacture/refurbishment is conspicuously absent at the PFC. One might be tempted to attribute this to differential collection on the part of the 1938 excavation party. But there is a near absence of any artifacts at the site today, suggesting those excavating the PFC collected nearly any artifact they encountered. However, it is altogether unknown at this point what the 17 lithic and groundstone lots at the MNA contain.

The fourth and most important pattern revealed in the artifact data is that items related to the processing and storage of food, and non-economic or ritual items are far and away the most common occurrences at the PFC (29% and 56% respectively for all floor assemblages). However if projectile points did not have a ritual function at the PFC, their high incidence relative to other specific artifact classes might be inflating the non-economic or ritual general artifact class. When projectile points are removed from consideration, food processing and storage becomes the most common general class. However, the non-economic or ritual class still dominates (22%) over the remaining classes. In short, ritual performances and food processing/storage were the primary and secondary activities that occurred at the PFC.

Unfortunately, a comparison of floor assemblages is possible only between the Pittsberg and Medicine Fort Complexes (Table 5.17) because sufficient data is not available for the Deadman's Fort Complex (Table 5.18) and because of the problematic nature of the Owl Fort Complex's assemblage (Table 5.19, see above). Further, floor assemblage data for the Medicine Fort's ancillary structures are not currently available which restricts comparisons to the fort features only. Despite these limitations, the data on specific artifact classes suggest the two forts

Table 5.17. Medicine Fort Complex artifact assemblage.

	NA862		NA1680		NA1239		NA863	
Provenience	**Floor**	**Any**	**Floor**	**Any**	**Floor**	**Any**	**Floor**	**Any**
Axe	-	-	-	-	-	-	-	-
Basket	-	Many	-	-	-	-	-	1
Bead	-	-	-	-	-	-	-	-
Bone Awl	-	4	-	-	-	-	-	-
Bowl	1	12+	-	-	-	-	-	4
Ceramic Disc	-	1	-	2	-	-	-	-
Cordage	-	-	-	-	-	-	-	1
Drill	-	-	-	-	-	-	-	-
Fabric	-	Many	-	-	-	-	-	Many
Food Item	-	Many	-	-	-	-	-	Many
Jar	20+	20+	-	-	-	-	-	6
Manuport	-	-	-	-	-	-	-	Many
Mano	2	4	-	-	-	-	-	-
Metate	-	6	-	-	-	-	-	-
Polishing Pebble	3	3	-	-	-	-	-	-
Projectile Point	21	39	-	-	-	-	-	-
Perforated Cermaic Disc	1	4	-	1	-	-	-	-
Stone Cylinder	-	1	-	-	-	-	-	-
Tool, Bone	-	4	-	-	-	-	-	-
Tool, Ceramic	-	2	-	-	-	-	-	-
Tool, Chipped Stone	18	46	-	-	-	-	-	1
Tool, Wood	-	1	-	-	-	-	-	-
Core	2	3	-	-	-	-	-	-
Jar Lid	5	3	-	-	-	-	-	6
Shell Bracelet	1	2	-	-	-	-	-	-
Shell Pendent	-	2	-	-	-	-	-	-
Stone Disk	-	1	-	-	-	-	-	-
Bone Fetish	-	1	-	-	-	-	-	-
Pigment	-	2	-	-	-	-	-	-
Pipe, Wood	-	-	-	-	-	-	-	1
Box, Mescal Stalk	-	-	-	-	-	-	-	1

Table 5.18. Deadman's Fort Complex artifact assemblage.

	Structure A		Structure C	
Provenience	**Floor**	**Any**	**Floor**	**Any**
Axe	-	-	-	-
Basket	-	-	-	-
Bead	-	-	-	-
Bone Awl	-	-	-	-
Bowl	-	-	-	-
Ceramic Disk	-	-	-	-
Cordage	-	-	-	-
Drill	-	-	-	-
Fabric	-	-	-	-
Food Item	-	-	-	-
Jar	-	1+?	-	-
Manuport	-	-	-	-
Mano	-	-	-	-
Metate	-	-	-	-
Polishing Pebble	-	-	-	-
Projectile Point	-	-	-	-
Perforated Ceramic Disc	-	-	-	-
Stone Cylinder	-	1+?	-	-
Tool, Bone	-	-	-	-
Tool, Ceramic	-	-	-	-
Tool, Chipped Stone	-	-	-	-
Tool, Wood	-	-	-	-
Core	-	-	-	-
Turquoise Pendent	-	1	-	-

Table 5.19. Owl Fort Complex artifact assemblage.

	Structure A		A or B	
Provenience	Floor	Any	Floor	Any
Axe	-	-	-	-
Basket	-	-	-	-
Bead	-	-	-	-
Bone Awl	-	-	-	-
Bowl	-	-	-	-
Ceramic Disk	-	-	-	-
Cordage	-	-	-	-
Drill	-	-	-	-
Fabric	-	-	-	-
Food Item	-	-	-	1
Jar	-	-	-	-
Manuport	-	-	-	3
Mano	-	4	-	-
Metate	-	-	-	-
Polishing Pebble	-	-	-	-
Projectile Point	-	-	-	2
Perforated Ceramic Disc	-	-	-	-
Stone Cylinder	-	-	-	-
Tool, Bone	-	-	-	-
Tool, Ceramic	-	-	-	-
Tool, Chipped Stone	-	-	-	10
Tool, Wood	-	-	-	-
Core	-	-	-	5
Stone Ball	-	1	-	-

contained similar assemblages when they burned down despite their being more than 53km apart. When the Medicine Fort assemblage is collapsed into the eight broad functional classes I defined, a similar pattern of activities to that of the Pittsberg Fort emerges, but with some differences (Figure 5.26). Activities concerned with processing, storing, and consuming food along with non-economic or ritual activities emerge as dominant themes in the Medicine Fort assemblage. However, manos and metates are not as prevalent at Medicine Fort as they are at Pittsberg Fort. I excluded the “food item” and “basket” specific artifact class from the Medicine Fort “food storage” general class because specific counts do not exist for these items, although Hargrave’s (1933) descriptions indicate there where many instances of both specific artifact classes. Items

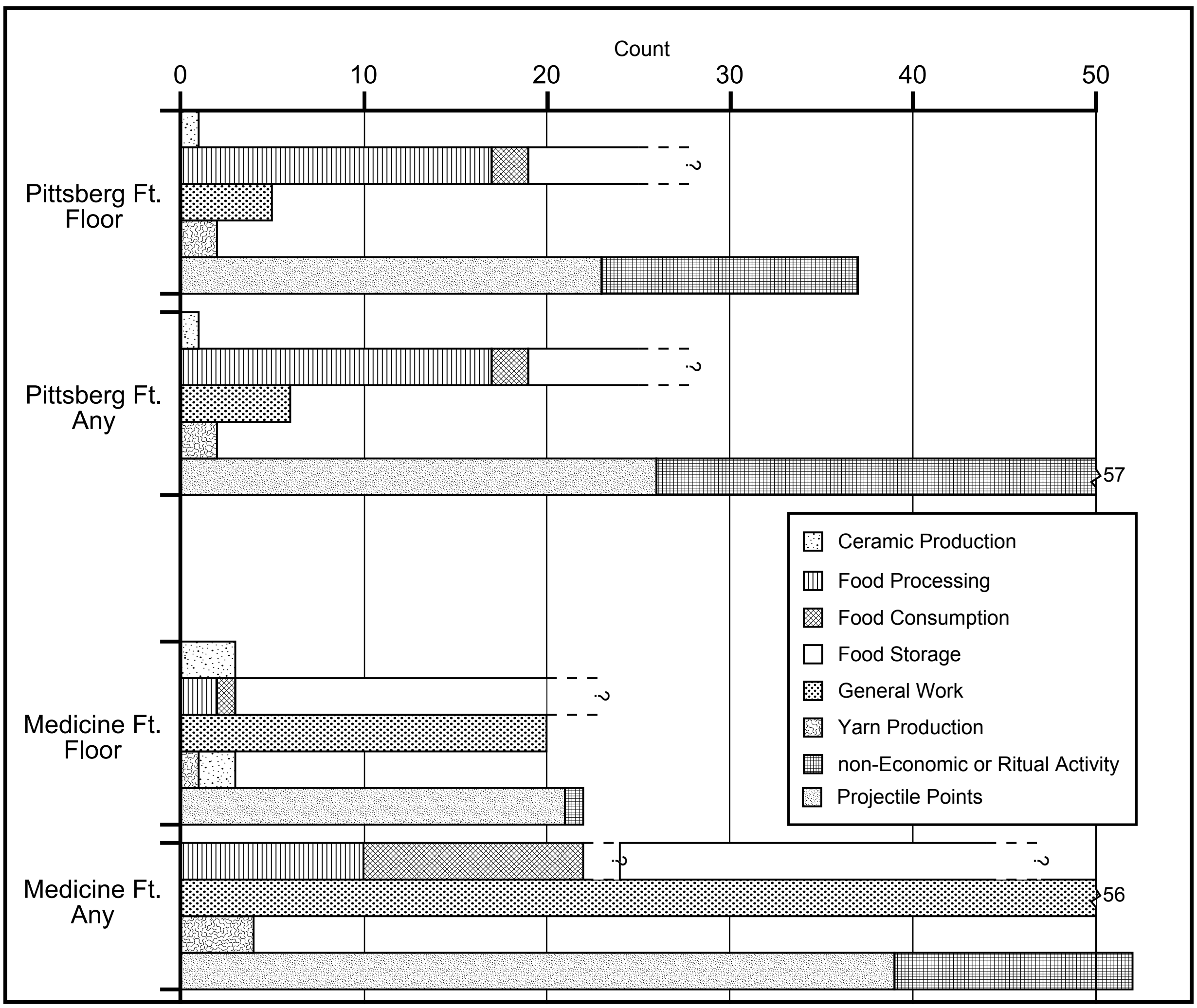

Figure 5.26. Comparison of artifact assemblages at the PFC and MFC.

of personal adornment have similar floor distributions between the forts, but are more common overall at the Medicine Fort and in greater variety. Projectile point counts are remarkably similar between the forts, while bone awls are more prevalent at the Pittsberg Fort. The single greatest difference evident in the data is the frequency of “general work” tools, which are nine times more prevalent at the Medicine Fort than the Pittsberg Fort. Overall, a similar pattern to Pittsberg Fort emerges at the Medicine Fort wherein ritual performances and food processing/storage were the primary and secondary activities that occurred at the PFC.

The Final Use of Cohonina Forts

Nearly every Cohonina fort site known produces a Ceramic Cross Date between A.D. 1050 and 1150 (Table 5.20). Tree-ring dates from two of those fort sites (Medicine Fort Complex and Pittsberg Fort Complex) indicate they were built in A.D. 1049 and 1053 respectively (Robinson et al. 1975; Ahlstrom 1983; Downum 1988). The foregoing analyses provide strong support to the theory these sites were integrative facilities serving small communities

Table 5.20. Comparison of ceramic cross dates for known fort sites.

KNF Number	MNA Number	Site Name	CCD early	CCD mid	CCD late
03070100301		Kaibab Fort	A.D. 1050	A.D. 1100	A.D. 1150
03070100584		Dutch Kid Fort	A.D. 1050	A.D. 1063	A.D. 1075
03070100889	NA 3577	Pittsberg Fort Complex	A.D. 1050	A.D. 1100	A.D. 1150
03070200132		Twin Fort	A.D. 1080	A.D. 1115	A.D. 1150
03070200706		Red Hill Fort	A.D. 1025	A.D. 1050	A.D. 1075
03070200708		Elk Fort	A.D. 1050	A.D. 1125	A.D. 1200
03070200804		Pumpkin Fort	A.D. 1065	A.D. 1133	A.D. 1200
03070201385		Piñon Nut Fort	A.D. 1050	A.D. 1100	A.D. 1150
	NA 0862	Medicine Fort	A.D. 1050	A.D. 1065	A.D. 1080
	NA 1765	Deadman's Fort	A.D. 1065	A.D. 1095	A.D. 1125
	NA 2076		-	-	-
	NA 4154		-	-	-
03070400450	NA 5145	Owl Fort	A.D. 1050	A.D. 1100	A.D. 1150

wherein a variety of ritual and secular activities occurred. The sudden appearance of Cohonina forts in the archaeological record clearly indicates something dramatic happened to the basic structure of Cohonina social organization in the mid-11th century.

The sample of four fort sites for which excavation data exist indicate three of those sites (Medicine, Deadmans, and Pittsberg Fort Complexes) burned to the ground while still in use and their floor assemblages in place. The builders of the fourth site (Owl Fort Complex) abandoned those structures before they were completed and there is some evidence it burned as well (McGregor 1951:78). It would be safe to explain the burning of a single structure at each of these sites as a result of accident. However, the fact that every structure burned at these sites, Owl Fort Complex notwithstanding, suggests equally dramatic events marked the end of forts in Cohonina social organization and interaction. Natural disasters such as wild fires or purposeful human action are possible causes of the conflagrations, but it is impossible at this point to know for sure how the fires started. Unfortunately, it is impossible at this juncture to precisely date when these events occurred beyond tree ring and ceramic cross dates indicating the conflagrations at the Pittsberg Fort Complex and Medicine Fort Complex both occurred sometime between A.D. 1080 and 1150.

The last commonality between the excavated sample of Cohonina forts has to do with their reuse as a burial place, although the Owl Fort Complex is again an exception to this pattern. The interval between the fires at the PFC, Deadman's Fort Complex, and Medicine Fort Complex and their collective use as a burial places is unknown, but it was likely short. At the PFC, a burial party excavated through wall and roof debris to inter an older adult (sex unknown) in the northwest corner of Structure A (the fort). The burial lacked any accompaniments, making it impossible to secure any date at all for that event, but it is noteworthy that the walls of the fort had collapsed before the burial occurred. A burial also occurred at Deadman's Fort, but little information is currently available for this event which precludes any discussion as to when it occurred.

At the Medicine Fort Complex a burial party excavated through roof debris in Room I of the fort (located in the southeast corner) to inter an infant with several burial accompaniments. Hargrave (1933) thought Room I had been reoccupied and a small brush structure built within it after the fort burned. However, this is doubtful given the composition of the strata he encountered in that room. Hargrave (1933), Downum (1988), and MNA archives indicate 5 strata were recorded within Room 1. The lowest stratum (Layer 5) consisted of artifacts lying directly on the floor of the room. Layer 4 consists of artifacts lying on or just above the floor of the room, but it unclear how it differed from Layer 5. Layer 3 was described as midden deposits and it is again unclear how it differed from the strata below. Layer 2 was primarily roof fall and had two recognizable components in the north and south halves of the room. The south component consisted of collapsed roof material overlain by crushed vessels and small burned pine poles. The latter objects are what Hargrave pointed out as evidence of a reoccupation. However, the roofs of forts were likely used as activity areas (see Chapters 3 and 4) and these items most likely represent a roof assemblage that was in place when the fort burned. The northern portion of Layer 2 was described as midden accumulation. The uppermost stratum (Layer 1) consisted of fallen wall rock. The infant burial was found “in and between 1st and 2nd layer” (Downum 1988:390, quoting MNA field notes). Although this statement is somewhat ambiguous, it seems to indicate the walls of the fort were still standing when the burial party interred the infant within the burned structure. The walls collapsed sometime after, crushing the remains of the infant and the burial accompaniments. The presence of a small Rio de Flag bowl in the burial assemblage indicates the death and burial of the infant within the burned fort occurred before, or shortly after, the eruption of Sunset Crater between A.D. 1080 and 1085 (Elson 2011). However, the Rio de Flag bowl could have been an heirloom item; meaning the burial could have occurred as late as A.D. 1150.

Visibility Analysis of Cohonina Public Architecture

I hypothesized in Chapter 4 that creating and maintaining lines of intervisibility with other community's integrative facilities was a primary factor architects at the Pittsberg Community considered in choosing where to build their own integrative facilities (Figure 5.27, Table 5.21). The architects of the Pittsberg Fort Complex (PFC) could have placed their integrative facilities anywhere within their community, the boundaries of which I defined above. An initial line-of-sight analysis (conducted using ArcGIS 10) indicates visual connections do exist between a number of Cohonina public architecture sites (Figure 5.28). I used viewshed analysis to test whether or not these lines-of-sight reflect intentional directed action on the part of the Cohonina community members.

Viewshed Analysis

In order test intentionality in line-of-sight connections I modeled the Area of Visual Redundancy (AVR) within the Pittsberg community using ArcGIS 10 software. First, I calculated a single unrestricted viewshed from the PFC to model what can be seen from that site (Figure 5.29). This exercise revealed that southern views from the PFC are blocked by Pittsberg. This situation presents a problem because the Kaibab Fort Complex (KFC) lies to the south of Pittsberg and out of view of the PFC. If intervisibility between the Pittsberg and Kaibab Community's integrative facilities was important, then an intermediate location between the PFC and the KFC would have been needed to act as a relay. In Chapter 4 I explained how the unique visual properties of the Sky Site (Figure 5.30) singled it out as a potential integrative facility; meaning it could have acted as just such a relay. Thus I calculated a single unrestricted viewshed from the Sky Site as well. I combined these single viewsheds to create a multiple viewshed, modeling what can be seen from both sites simultaneously (Figure 5.31). I then used the resulting shapefile to capture all known Cohonina site features exhibiting architectural remains (this

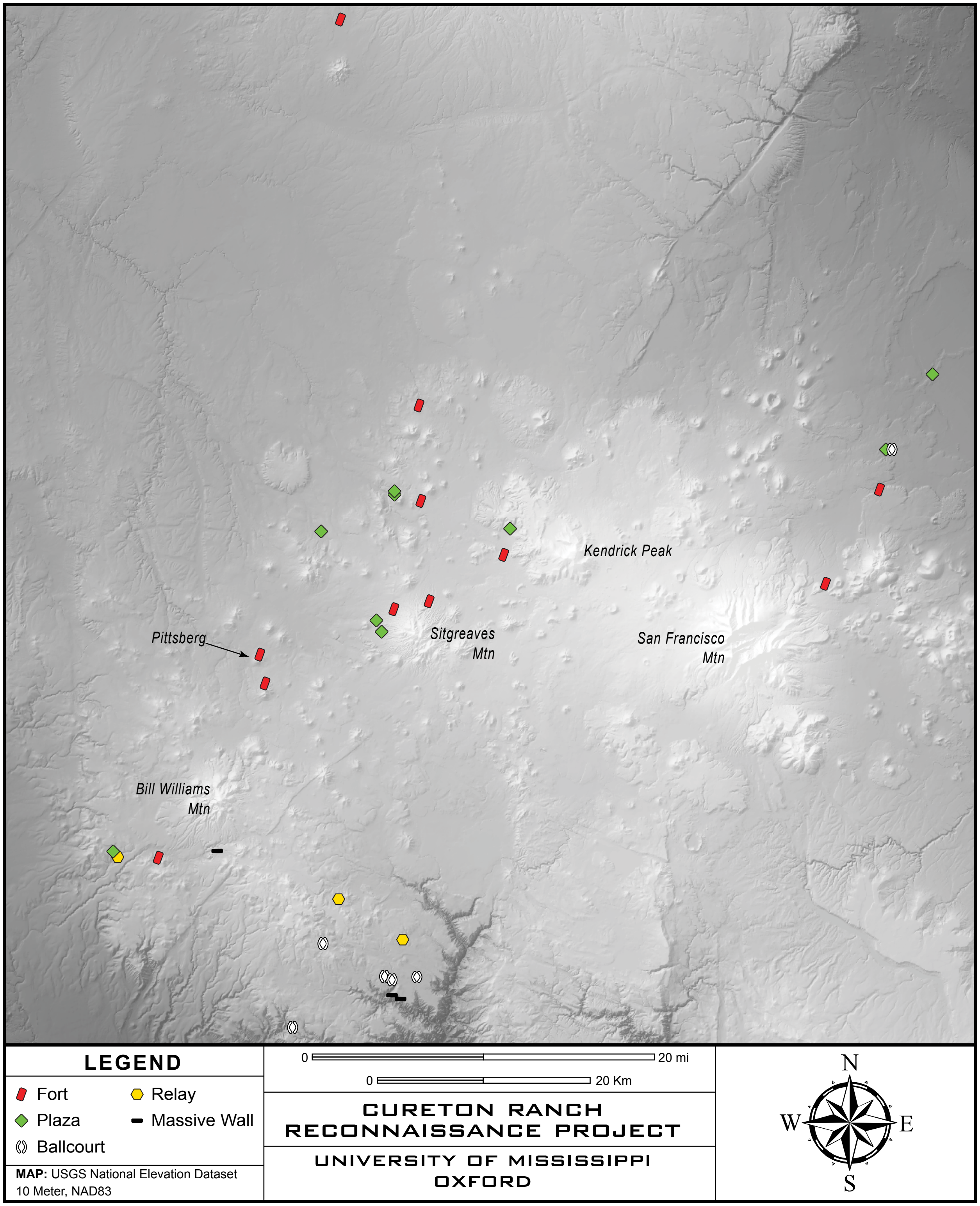

Figure 5.27. Known Cohonina public architecture sites.

Table 5.21. Known Cohonina public architecture sites.

KNF Site	MNA Site	Site Name	Type	Reference
03070100018			Relay	Remley 1989; Bone 2002
03070100127		Sycamore Point Ballcourt	Ballcourt	Wilcox et al. 1996; Bone 2002
03070100301		Kaibab Fort	Fort	Bone 2002
03070100584		Dutch Kid Fort	Fort	Wilcox 1995; Bone 2002
03070100746		Devil's Village	Plaza	Remley 1989; Bone 2002
03070100889	NA 3577	Pittsberg Fort Complex	Fort	Hargrave 1938; Bone 2002
03070100906			Relay	Remley 1989; Bone 2002
03070101082			Massive Wall	Wilcox 1995
03070101126			Massive Wall	Wilcox 1995
03070101187			Massive Wall	Wilcox 1995
03070101200		Devil's Lookout	Relay	Bone 2002
03070101323		Round Mountain Ballcourt	Ballcourt	Wilcox et al. 1996; Bone 2002
03070101398		JD Ballcourt	Ballcourt	Wilcox et al. 1996
03070101467		Sky Site	Relay	USFS Site Card; this thesis
03070102269		Butler Ballcourt	Ballcourt	USFS Site Card; this thesis
03070102365	NA 10519	Wagner Hill Ballcourt	Ballcourt	Wilcox et al. 1996; Bone 2002
03070200132		Twin Fort	Fort	Bone 2002
03070200140	NA 3594		Walled Plaza	Samples 1992; Bone 2002
03070200152		Walavudu	Walled Plaza	Samples 1992; Bone 2002
03070200316	NA 20822	Horse Trap	Walled Plaza	Bone 2002
03070200534		Pumpkin Pueblo	Plaza	Wilcox 1995; Bone 2002
03070200706		Red Hill Fort	Fort	Bone 2002
03070200708		Elk Fort	Fort	Wilcox 1995
03070200804		Pumpkin Fort	Fort	Bone 2002
03070200836		Cedar House	XL Pithouse	USFS Site Card; this thesis
03070201385		Piñon Nut Fort	Fort	Bone 2002
03070201456		Scarp Pueblo	Plaza	Wilcox 1995; Bone 2002
03070201457		Scarp Plaza	Walled Plaza	Wilcox 1995; Bone 2002
	NA355	The Citadel	Walled Plaza	Stone and Downum 1999
	NA804	Ball Court No. 2	Ballcourt	Colton 1946
	NA862	Medicine Fort	Fort	Hargrave 1933; Garcia 2004
	NA1765	Deadman's Fort	Fort	Colton 1946; Garcia 2004
	NA1814	Juniper Terrace	Walled Plaza	Colton 1946; Wilcox 1995
	NA2076		Fort	Colton 1946
	NA4154		Fort	Colton 1946
	NA5145	Owl Fort	Fort	McGregor 1951; Wilcox 1995
		Second Sink	Ballcourt	Wilcox et al. 1996
		Wupatki Road	Ballcourt	Wilcox et al. 1996

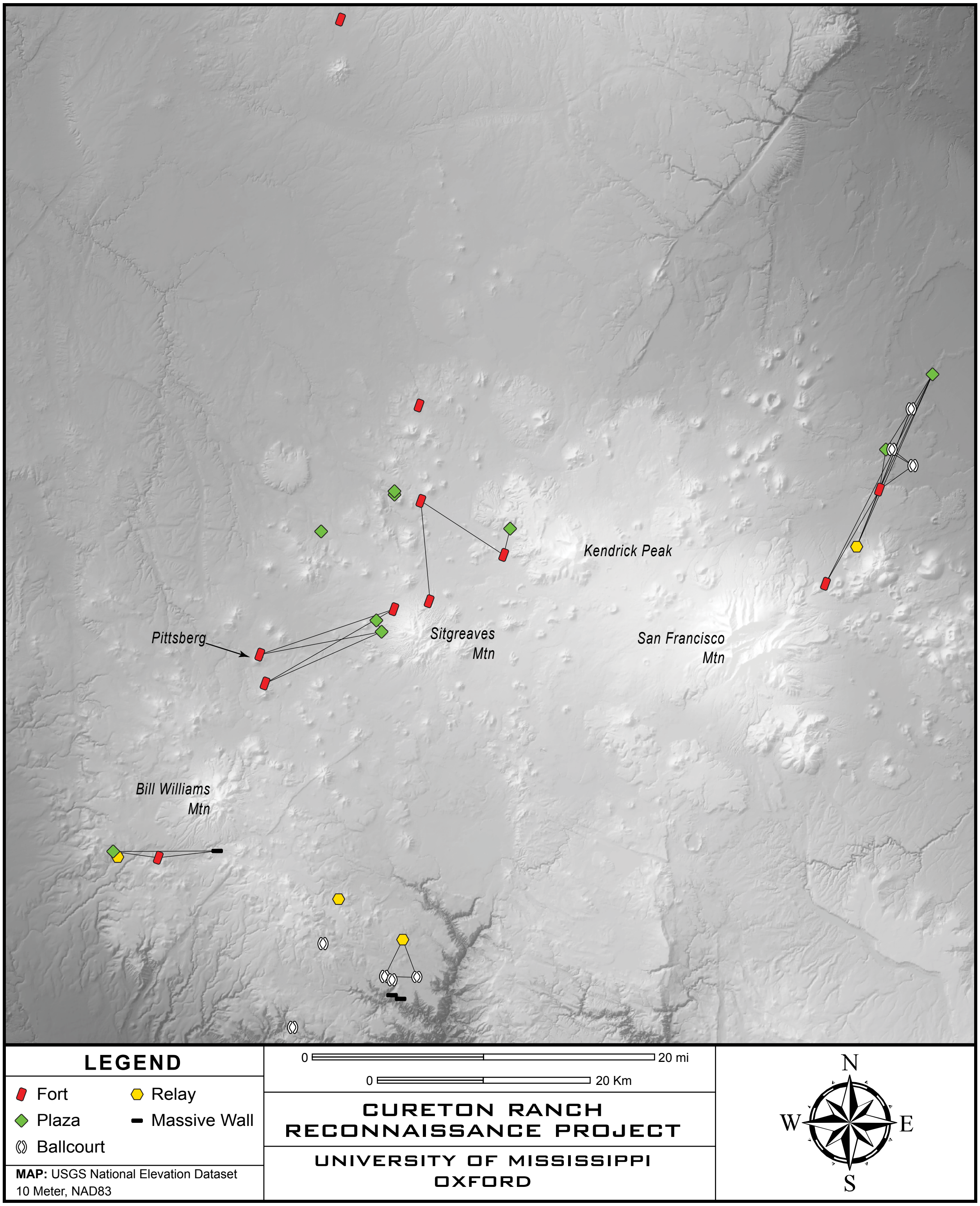

Figure 5.28. Lines-of-sight between known Cohonina public architecture sites.

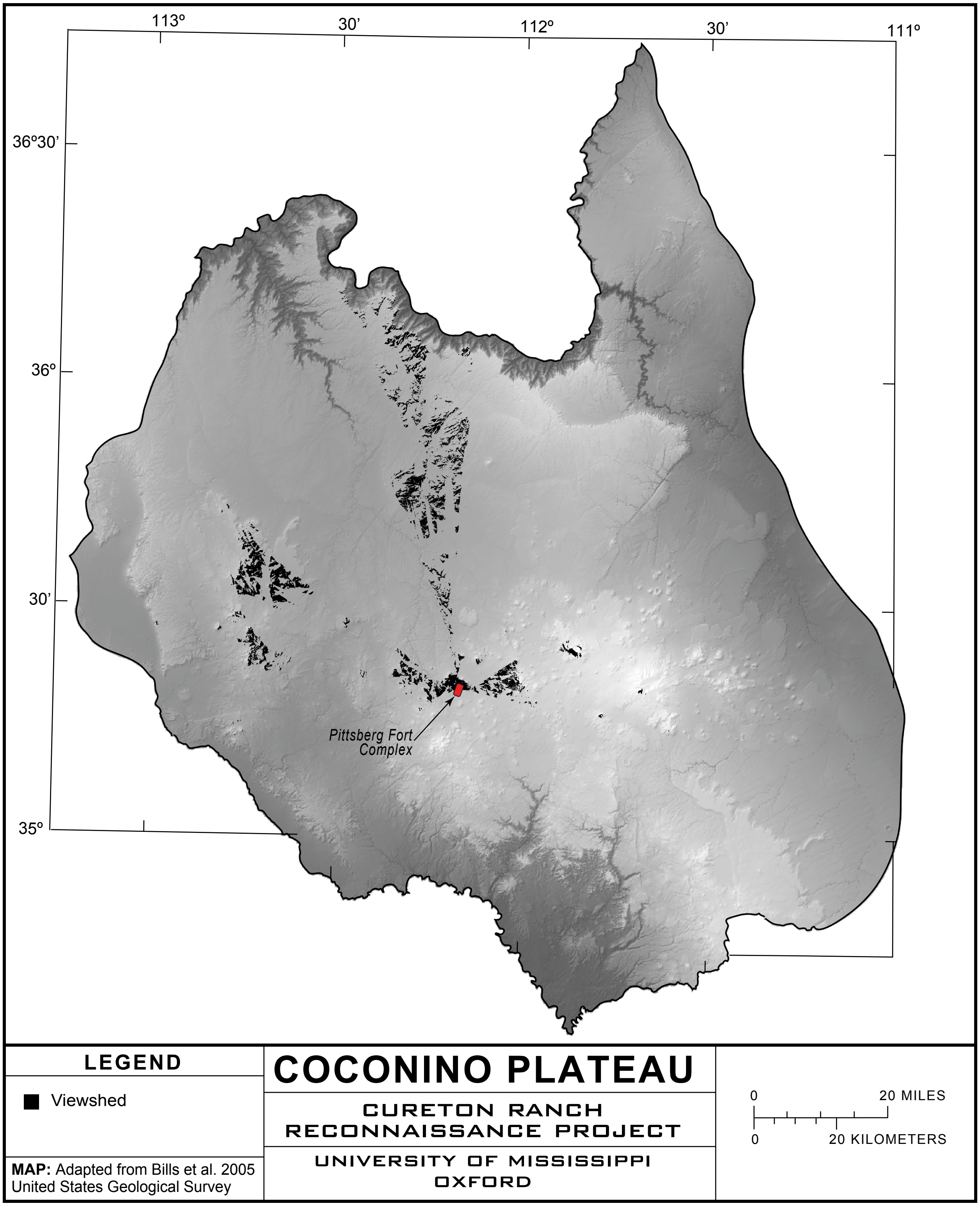

Figure 5.29. Viewshed of an observer standing atop the Pittsberg Fort.

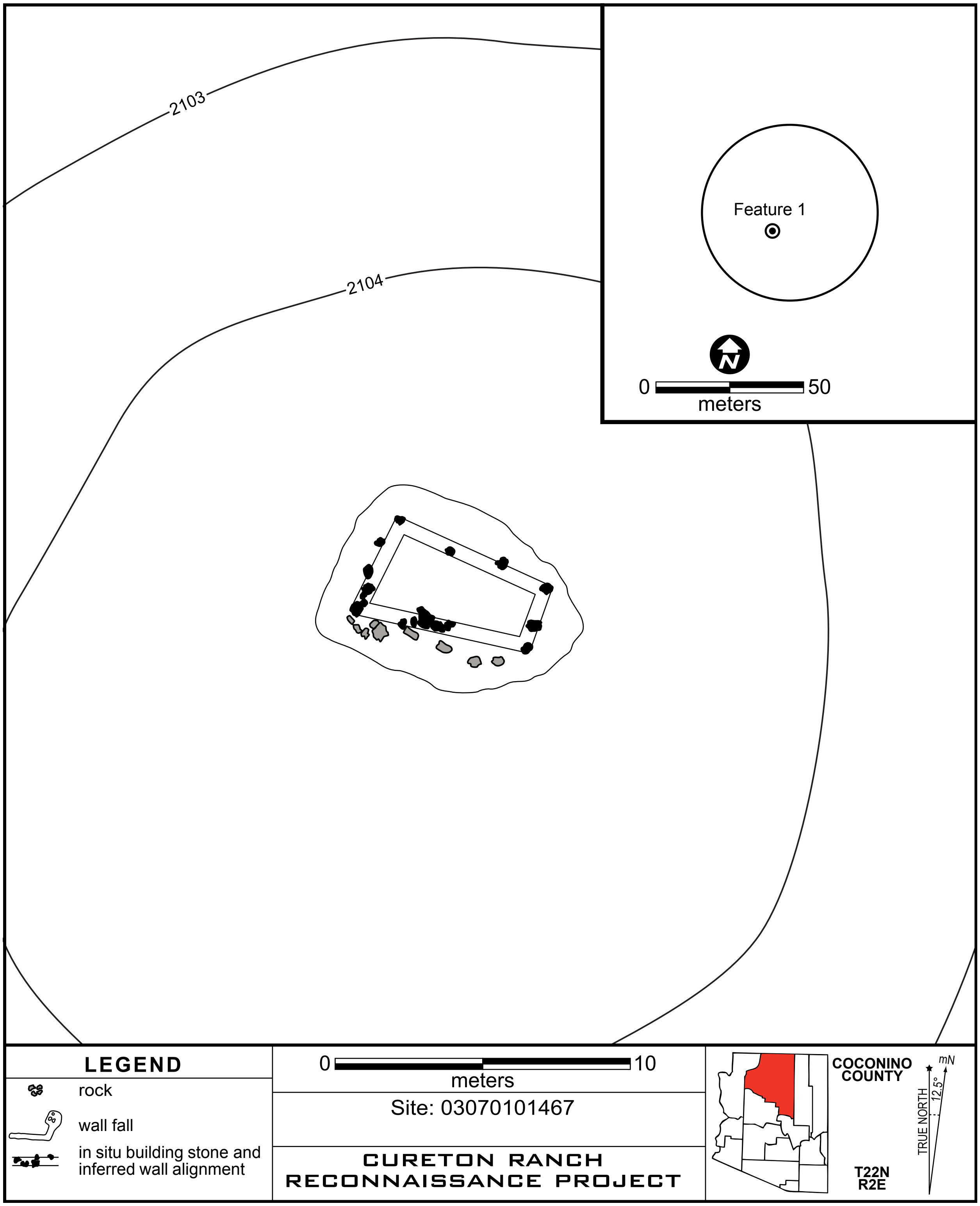

Figure 5.30. The Sky Site.

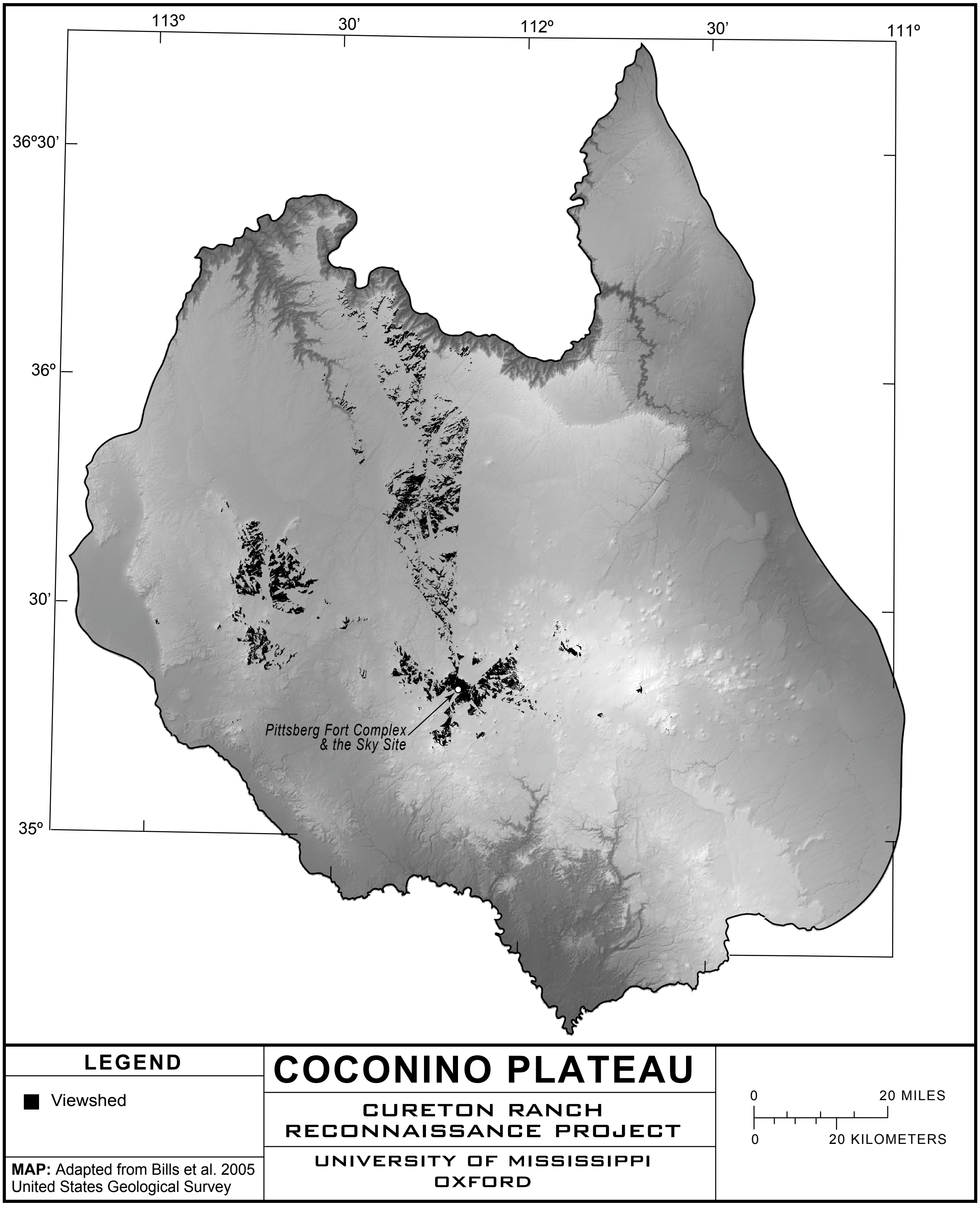

Figure 5.31. Multiple viewshed from Pittsberg.
Modeled for observers standing atop the Pittsberg Fort and the structure at the Sky Site.

Table 5.22. Cohonina public architecture sites captured by multiple viewshed.

KNF Number	Site Name	Nearby Geogrpahic Feature	Public Architecture
03070100301	Kaibab Fort	Kaibab Hill	Fort Complex
03070101169		Bill Williams Mountain	Possible Relay
03070102153		Cemetery Hill	Possible Relay
03070200152	Walavudu	Sitgreaves Mountain	Walled Plaza
03070200836	Cedar House	Cedar Mountain	Extra-Large Pithouse

also included those features without an assigned cultural affiliation or "Other" function type) within the Kaibab National Forest archaeological database (Williams and Tusayan Districts) that intersect the PFC and Sky Site multiple viewshed (Figure 5.32, Appendix C). I examined the resulting dataset of 187 sites and their associated site cards for known and unknown examples of public architecture. I (or volunteers) also conducted field reconnaissance at sites exhibiting extensive architectural debris or large architectural features when possible. These efforts resulted in the segregation of 3 known public architecture sites, 1 unknown public architecture site, and a set of 2 possible relay sites from the set of sites intersecting the PFC and Sky Site multiple viewshed (Table 5.22).

Site 03070100301 (Kaibab Fort Complex) (Figure 5.33) is a previously known Cohonina fort site located on Kaibab Hill approximately 2.75km south of the Pittsberg Fort Complex. It is also the nearest example of public architecture to the Pittsberg settlement pattern. Site 03070101169 is a small two-room, rectangular masonry structure located near the apex of a foothill on the east side of Bill Williams Mountain. The surveyor who recorded the site did not find any artifacts, making it impossible at this point to determine the structure's age or cultural affiliation. Because so little is known about this site and because time constraints prevented a site visit by the author, it is not considered in the next analysis. However, it is worth mentioning this structure because its size, shape, and position near the apex of a foothill are all similar to that of the Sky Site located within the Pittsberg settlement system; the latter of which I hypothesize acted as a relay between the PFC and other public architecture sites. A similar situation exists for Site 03070102153 an amorphous pile of architectural debris located at the apex of Cemetery Hill,

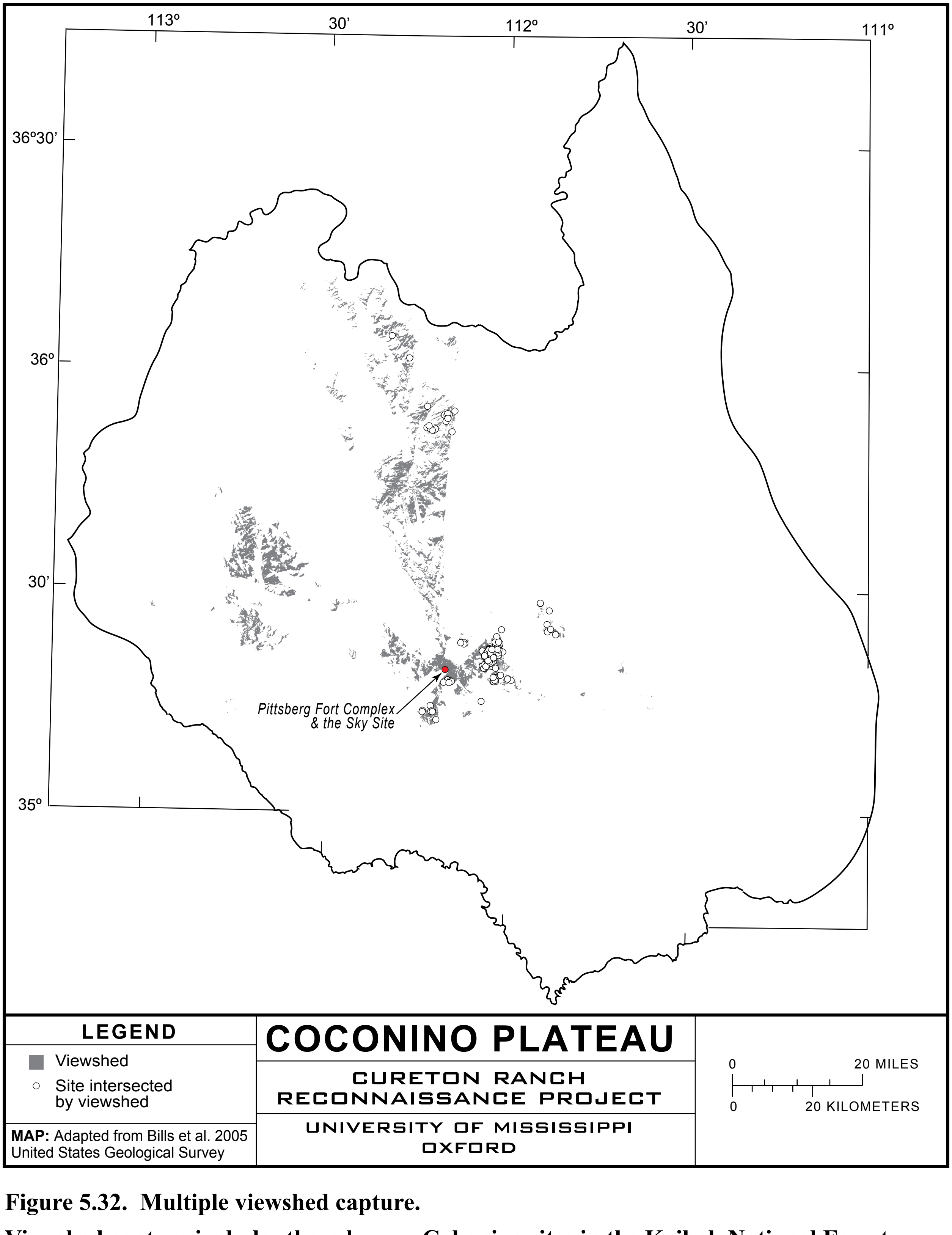

Figure 5.32. Multiple viewshed capture.

Viewshed capture includes those known Cohonina sites in the Kaibab National Forest Database exhibiting architectural features.

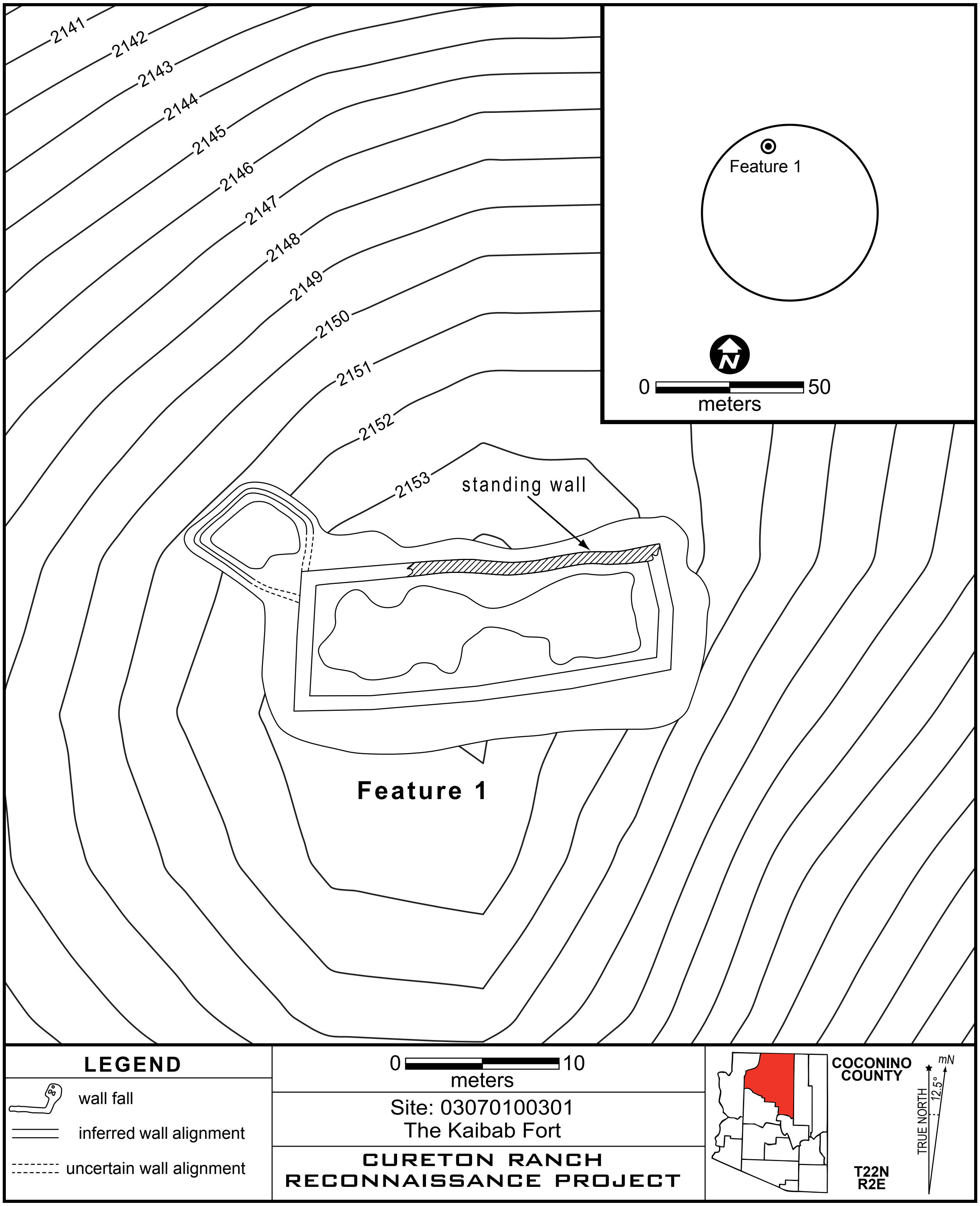

Figure 5.33. The Kaibab Fort Complex.

northeast of Bill Williams Mountain. The characteristics of Site 2153 are similar to the Sky Site, but survey information is scant for the former and time constraints prevented a site visit as well. Thus it is not considered in the next analysis.

The viewshed analysis captured 138 sites within the Sitgreaves settlement system and there are seventeen examples of public architecture within that settlement system. However, the locations and site numbers of only 4 of those sites are confidently known (Sites 03070200132 [fort], 020140[plaza], 020152[plaza], and 020708 [fort]). This excludes the thirteen examples of extra-large pithouses Samples (1992) reports exist within that settlement system. Time constraints prevented the author from relocating these extra-large pithouse sites. Regardless, Site 03070200152 (Walavudu) (Figure 5.34) is the only public architecture site within the Sitgreaves settlement system considered in the next analysis (see Chapter 4 for justification). Data collected during the 1938 MNA expedition as well as the KNF archaeological database indicate a Cohonina community existed on the slopes of Cedar Mountain. The viewshed analysis captured eight sites in the area, none of which were recognized public architecture sites. An examination of those site cards revealed Site 03070200836 (Cedar House) consisted of several circular depressions and architectural rubble positioned higher than any other known site on Cedar Mountain. KNF archaeologists Neil Weintraub and Mike Lyndon visited the site in the Fall of 2012 and noted the presence of a deep circular depression greater than 10m in diameter adjacent to a rectangular masonry outline (Figure 5.35). The author considers the former feature an example of an extra-large pithouse and thus classified the site as public architecture.

In order to model the Area of Visual Redundancy (AVR), or areas within the Pittsberg Community that an observer could maintain lines-of-sight with multiple extra-community integrative facilities, I created single unrestricted viewsheds for the Kaibab Fort, Cedar House, and Walavudu (Figure 5.36). I then used those viewsheds to create two cumulative viewsheds, or the area where multiple single viewsheds overlap, to model the AVR within the Pittsberg Community boundary. The first cumulative viewshed models the AVR of Walavudu and Cedar House (Figure 5.37) which both the PFC and the Sky Site intersect. This AVR covers 2.3% or .1338km^2 of the

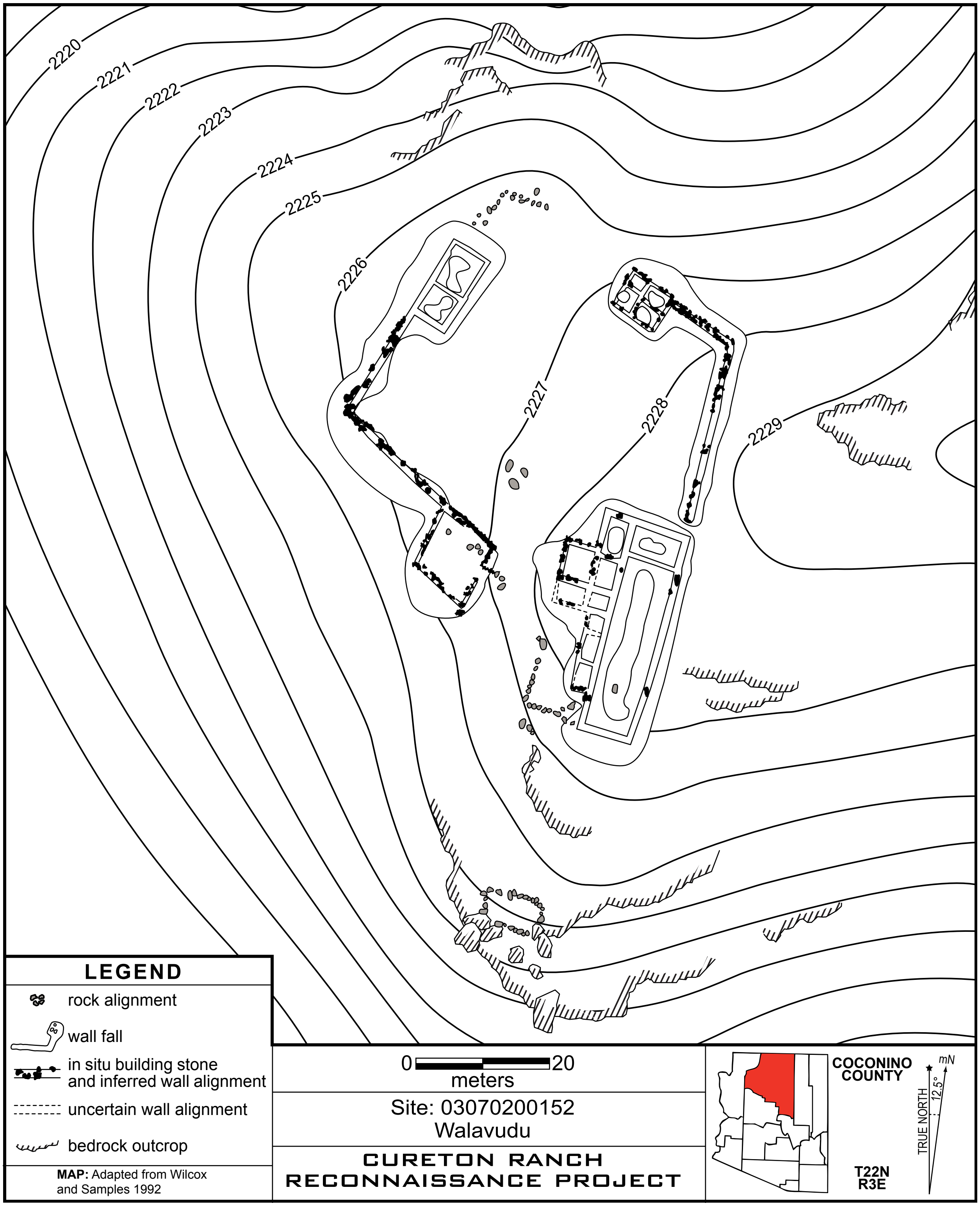

Figure 5.34. Walavudu.

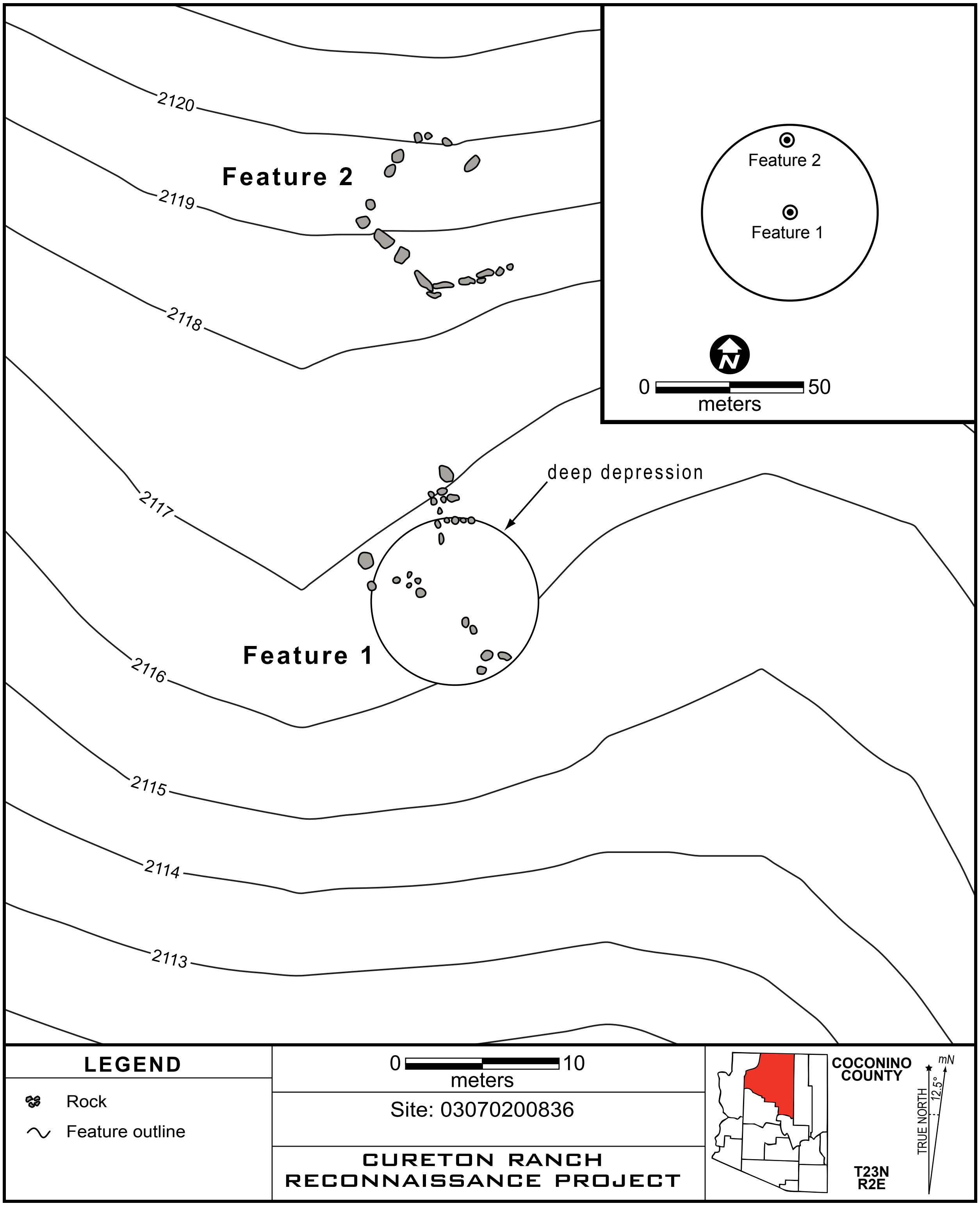

Figure 5.35. Cedar House.

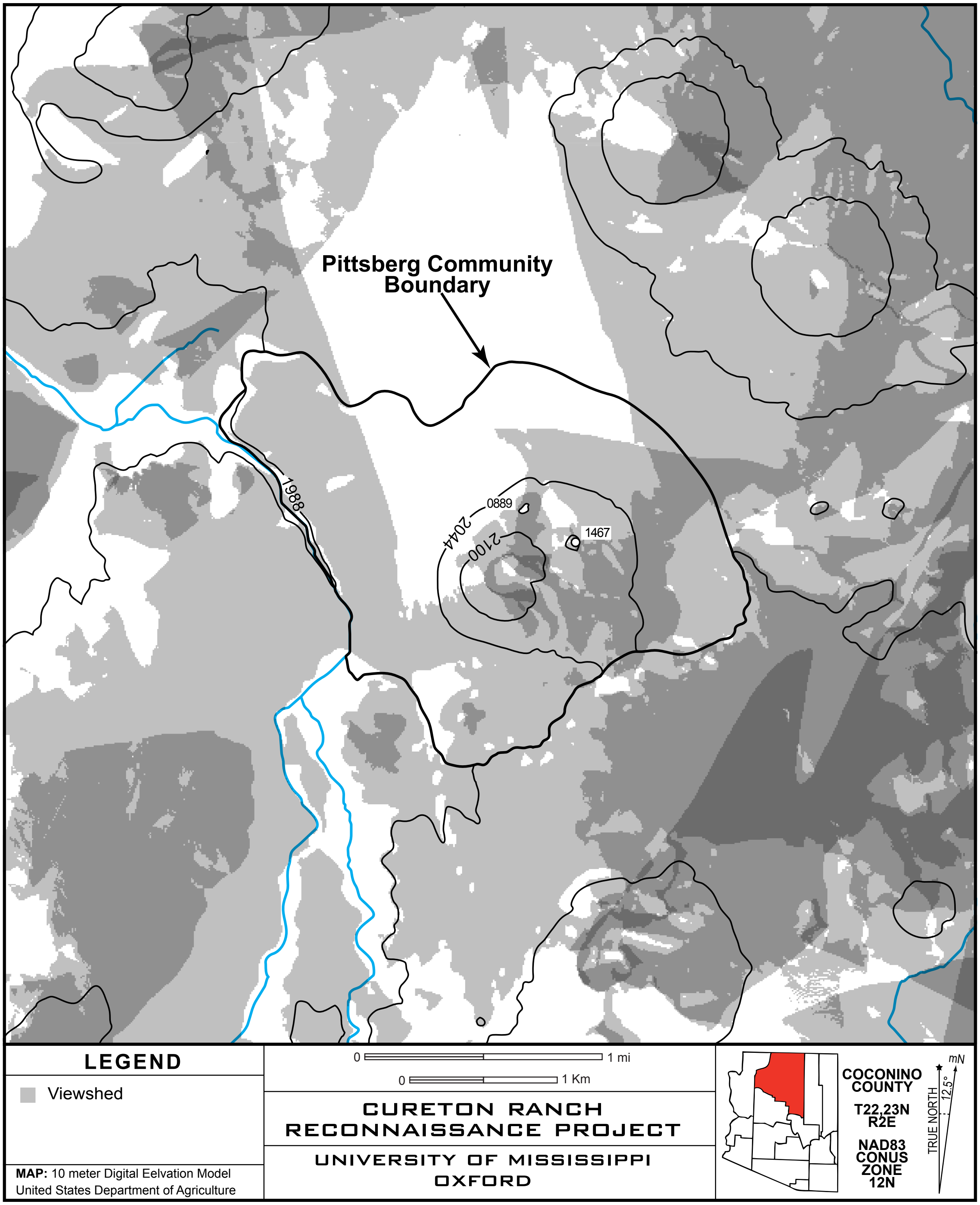

Figure 5.36. Overlapping viewsheds in the area of Pittsberg.

This includes viewsheds from Kaibab Fort, Cedar House, and Walavudu. Darker areas indicate greater viewshed overlap, while white areas are not within a viewshed.

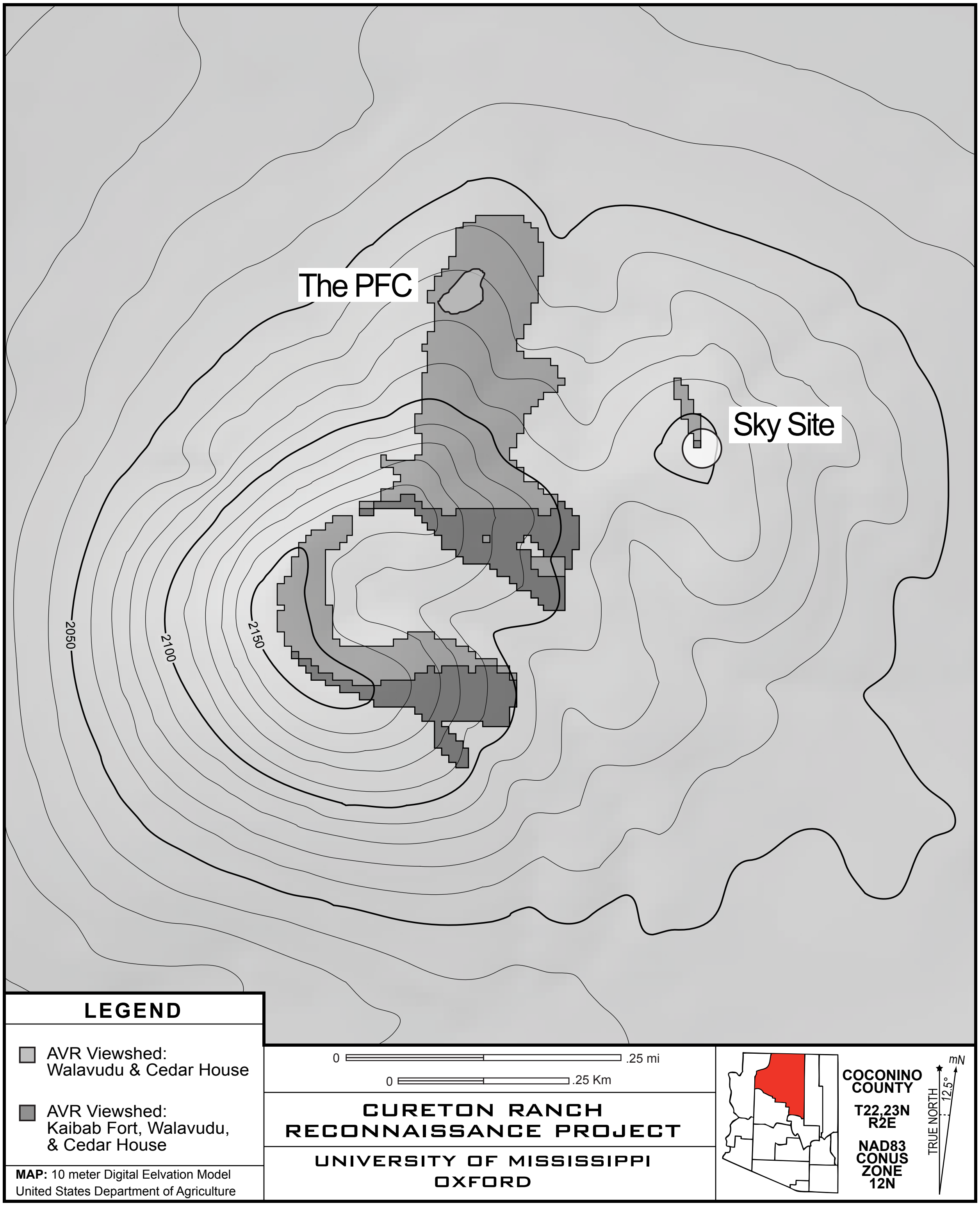

Figure 5.37. Multiple viewsheds at Pittsberg modeling areas of visual redundancy.

Pittsberg Community's total area. The second multiple viewshed models the AVR of Walavudu, Cedar House, and Kaibab Fort (Figure 5.37) which is intersected by the Sky Site, but not the PFC. This AVR covers .6% or .0373km^2 of the Pittsberg Community's total area. The Sky Site occupies an area of maximum visual redundancy within the Pittsberg settlement system while the PFC occupies an area of less visual redundancy. If observers situated at the PFC wished to make visual contact with observers located at the Kaibab Fort, they would need a person or persons positioned at the Sky Site to act as a relay.

Slope Analysis

The preceding viewshed analysis demonstrates that areas within the Pittsberg settlement system where an observer can maintain visual contact with multiple extra-settlement system integrative facilities is quite limited. Both the PFC and Sky Site fall within these limited areas of visual redundancy which lends considerable support to the hypothesis line-of-sight connections between Cohonina public architecture sites were created intentionally. However, it is still possible the PFC and Sky Site are located where they are for other reasons and the line-of-sight connections are the result of happenstance.

Examining the relationship between terrain slope and the AVRs just produced provides an additional test of intentionality. I argue the slope of terrain within the Pittsberg Community was a primary consideration Pittsberg architects considered when choosing building sites. Flatter terrain would have been desirable because it does not require as much effort to construct buildings as steeper terrain does. Builders would have had to work harder to level steep terrain and construct buildings than on flat terrain. An earlier slope analysis (see above) revealed those sites with substantial architecture (i.e. habitation sites) within the Pittsberg settlement system have a mean slope of 5.48° and a standard deviation of 3.14° slope. These values can be used to model those areas within the Pittsberg Community its members considered flat enough to build upon. For the purposes of this analysis, I consider those areas within the Pittsberg settlement system with -1σ° to x̄° slope to model "optimal" building areas and those areas with x̄° to +1σ° slope to model "flat enough" areas to construct buildings. Figure 5.38 provides a graphical display of these areas within the Pittsberg settlement system.

Some interesting correlations become evident when the Pittsberg settlement system slope values are compared to the AVRs just produced as well as the locations of the PFC and Sky Site. The Pittsberg Fort Complex is located in an isolated area that was flat enough for the Pittsbergers to build upon while the Sky Site is located in an area of both "optimal" and "flat enough" terrain

Table 5.23. Cross tabulation of slope values and areas of visual redundancy.

	Out of Viewshed: 0152 & 0836	**In Viewshed: 0152 & 0836**	**Out of Viewshed: 0301, 0152, & 0836**	**In Viewshed: 0301, 0152, & 0836**
<1σ° slope	2.600km²	.001km²	2.600km²	.001km²
-1σ° to x̄° slope	1.588km²	.003km²	1.590km²	.001km²
x̄ to +1σ° slope	.640km²	.017km²	.654km²	.002km²
>1σ° slope	.956km²	.113km²	1.036km²	.033km²

(Figure 5.39). A cross-tabulation of areas within and without the two AVRs with the generated slope values (Table 5.23, Figure 5.40) reveals only .34% or .0199km² of the Pittsberg settlement system is flat enough to build upon and falls with the AVR capable of maintaining lines-of-sight with Cedar House and Walavudu. The area within the Pittsberg settlement system that is flat enough to build upon and falls within the AVR capable of maintaining lines-of-sight with Kaibab Fort, Cedar House, and Walavudu is only .06% or .0036 km² of the total settlement area. The PFC and the Sky Site are located precisely within the areas just described, the former of which occupies the only substantial area of terrain flat enough to build upon within the Walavudu-Cedar House AVR.

Establishing contemporaneity between public architecture sites within the proposed line-of-sight network is a final test of intentionality. Earlier I described how most known Cohonina forts sites produce ceramic cross dates between A.D. 1050 and 1150. I compiled ceramic cross dates for all known Cohonina public architecture sites for which sufficient data exist as well as mean sherd thickness dates for the Pittsberg Fort Complex, Kaibab Fort Complex, Cedar House,

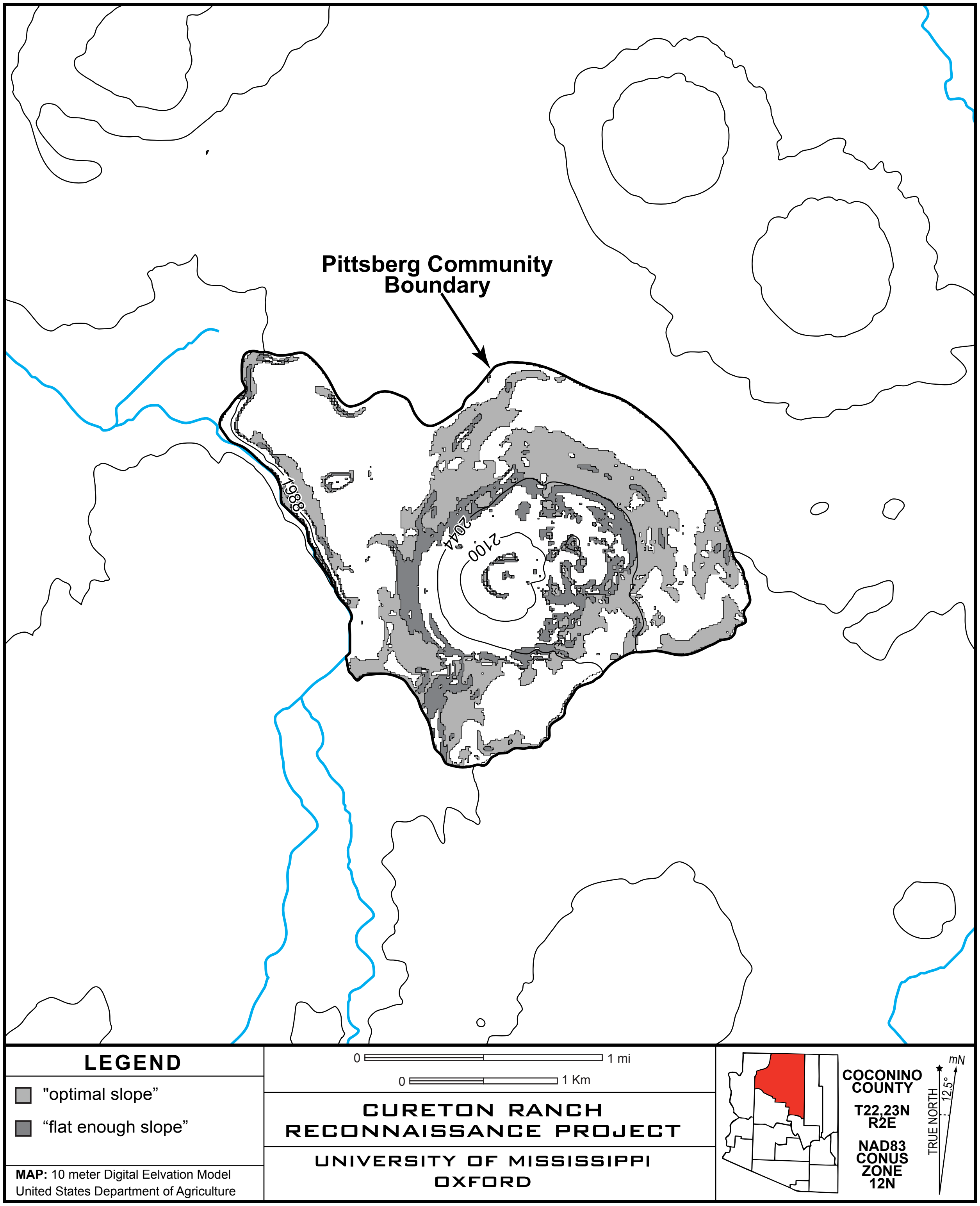

Figure 5.38. Suitable building areas within the Pittsberg Community boundary.

These areas are defined as those having slope values plus or minus one standard deviation off the mean slope value for habitation sites.

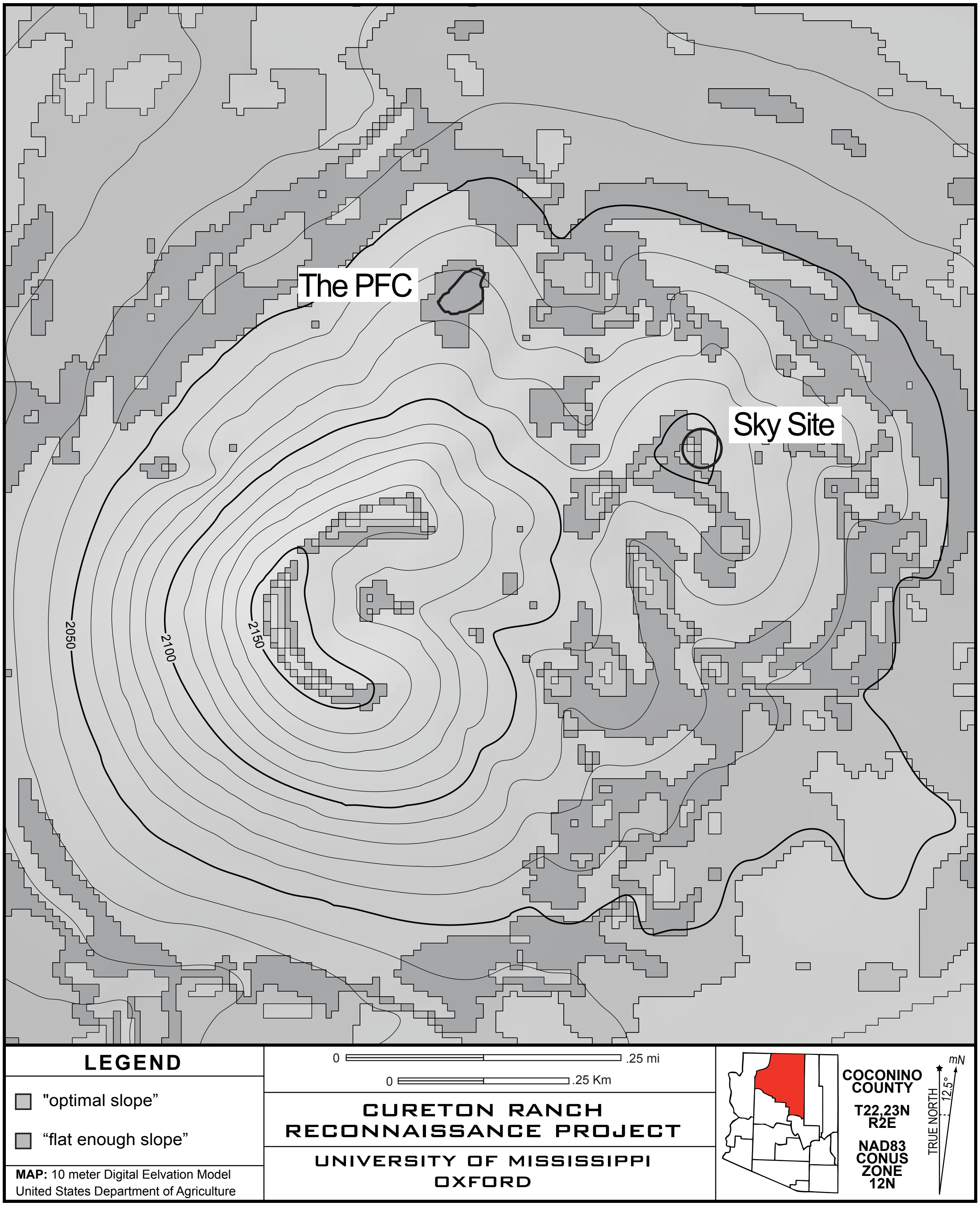

Figure 5.39. Slope values around the Pittsberg Fort Complex and the Sky Site.

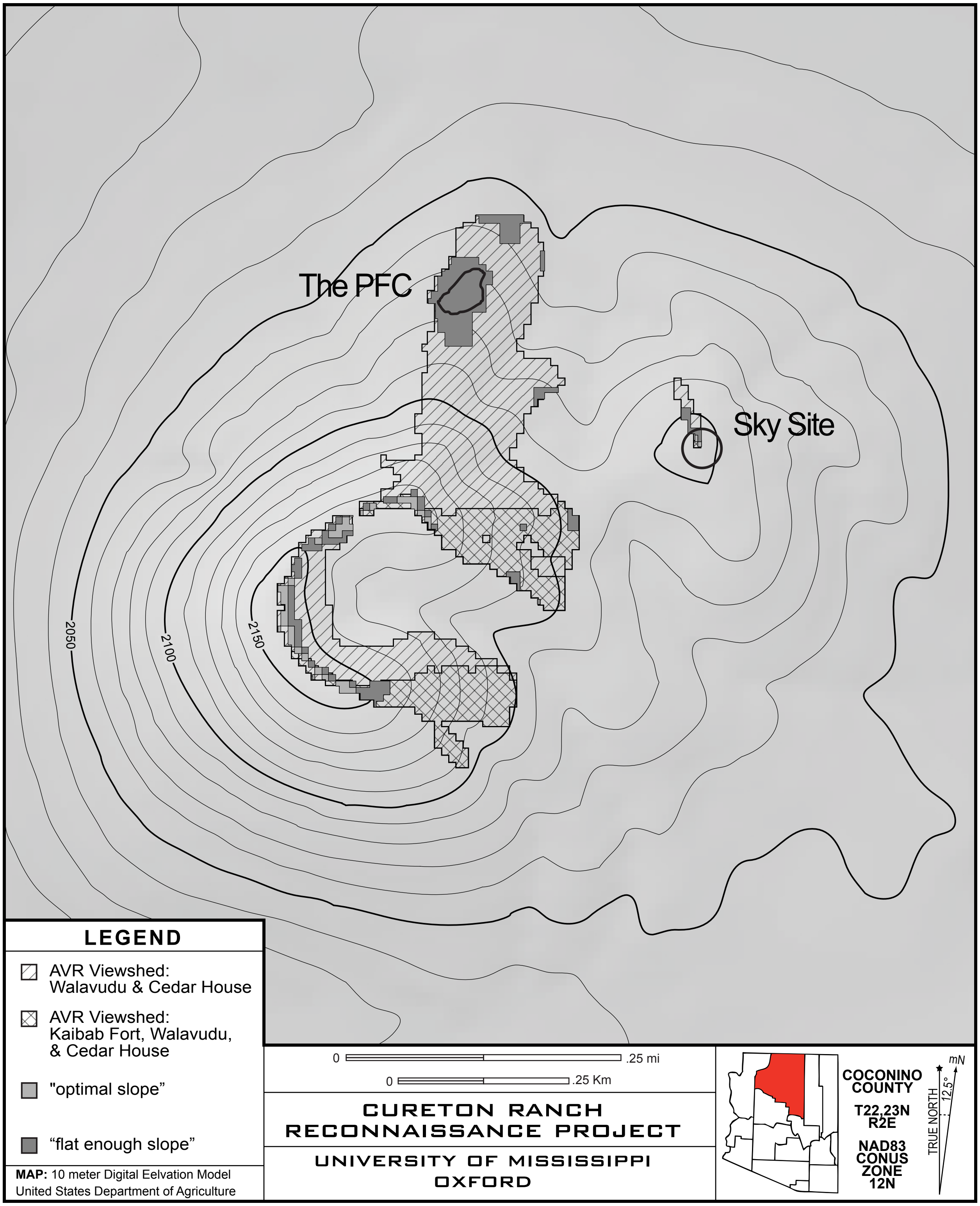

Figure 5.40. Location of suitable building areas within the areas of visual redundancy. Suitable building areas are defined by optimal and flat enough terrain, while the areas of visual redundancy are defined by Kaibab Fort, Cedar House, and Walavudu viewsheds.

Walavudu, and Medicine Fort Complex (Table 5.24, Figure 5.41). The data suggest the earlier generalization that forts are contemporaneous also extends to plaza sites, relays, and ballcourts. The 1-sigma MSTD date estimates for the PFC, Kaibab Fort, Cedar House, and Walavudu all overlap, also demonstrating contemporaneity for these sites. Given the accumulated facts and the assumption that the Pittsbergers could have chosen to build their integrative facilities anywhere within their community they deemed suitably flat; the chances that they did not intentionally position the PFC and the Sky Site to create lines-of-sight with other community's integrative facilities is vanishingly small. Therefore, the Pittsberg Fort Complex and the Sky Site are located where they are because the Cohonina of Pittsberg wanted their integrative facilities to have the greatest number of visual connections to other contemporary community's public edifices as possible.

A reanalysis of the theorized line-of-sight network (LOSN) including the Sky Site, Cedar House, and the two possible relays near Bill Williams Mountain, indicates a dense LOSN exists in the area west of Sitgreaves Mountain (Figure 5.42). Separate networks exist south of Bill Williams Mountain and in the Medicine Valley-Deadman area northeast of San Francisco Mountain. The density of connections evident in the network that includes the Pittsberg Fort Complex is likely attributable to the completeness of survey in the area and the intense search for examples of public architecture performed during the course of this thesis. I suspect equally intensive searches beginning at other Cohonina public architecture sites would produce similar results, which might establish connections between the several isolated networks.

Table 5.24. Temporal designations for Cohonina public architecture sites.

			Ceramic Cross Dates		Mean Sherd Thickness Date		
Site Number	Site Name	Type	Early	Late	Early	Mean	Late
03070100018		Relay	-	-	-	-	-
03070100127	Sycamore Point	Ballcourt	A.D. 1025	A.D. 1150	-	-	-
03070100301	Kaibab Fort	Fort	A.D. 1025	A.D. 1150	A.D. 1103	A.D. 1145	A.D. 1187
03070100584	Dutch Kid Fort	Fort	A.D. 1050	A.D. 1075	-	-	-
03070100746	Devil's Village	Plaza	A.D. 1065	A.D. 1150	-	-	-
03070100889	Pittsberg Fort	Fort	A.D. 1050	A.D. 1150	A.D. 1071	A.D. 1113	A.D. 1155
03070100906		Relay	-	-	-	-	-
03070101082		Massive Wall	-	-	-	-	-
03070101126		Massive Wall	-	-	-	-	-
03070101187		Massive Wall	-	-	-	-	-
03070101200	Devil's Lookout	Relay	A.D. 800	A.D. 1200	-	-	-
03070101323	Round Mountain	Ballcourt	A.D. 1065	A.D. 1200	-	-	-
03070101398	JD Ballcourt	Ballcourt	A.D. 800	A.D. 1200	-	-	-
03070101467	Sky Site	Relay	A.D. 1050	A.D. 1150	-	-	-
03070102269	Butler Ballcourt	Ballcourt	-	-	-	-	-
03070102365	Wagner Hill	Ballcourt	A.D. 1050	A.D. 1150	-	-	-
03070200132	Twin Fort	Fort	A.D. 1080	A.D. 1150	-	-	-
03070200140		Walled Plaza	A.D. 1025	A.D. 1150	-	-	-
03070200152	Walavudu	Walled Plaza	A.D. 1025	A.D. 1150	A.D. 1089	A.D. 1131	A.D. 1173
03070200316	Horse Trap	Walled Plaza	A.D. 1025	A.D. 1150	-	-	-
03070200534	Pumpkin Pueblo	Plaza	A.D. 1050	A.D. 1200	-	-	-
03070200706	Red Hill Fort	Fort	A.D. 1025	A.D. 1075	-	-	-
03070200708	Elk Fort	Fort	A.D. 1050	A.D. 1200	-	-	-
03070200804	Pumpkin Fort	Fort	A.D. 1065	A.D. 1200	-	-	-
03070200836	Cedar House	XL Pit House	A.D. 1065	A.D. 1150	A.D. 1108	A.D. 1150	A.D. 1192
03070201385	Piñon Nut Fort	Fort	A.D. 1025	A.D. 1150	-	-	-
03070201456	Scarp Pueblo	Plaza	A.D. 1025	A.D. 1150	-	-	-
03070201457	Scarp Plaza	Walled Plaza	A.D. 1025	A.D. 1150	-	-	-
NA355	The Citadel	Walled Plaza	A.D. 1080	A.D. 1200	-	-	-
NA804	Ball Court No. 2	Ballcourt	A.D. 1150	A.D. 1200	-	-	-
NA862	Medicine Fort	Fort	A.D. 1050	A.D. 1080	A.D. 1039	A.D. 1081	A.D. 1123
NA1765	Deadman's Fort	Fort	A.D. 1065	A.D. 1125	-	-	-
NA1814	Juniper Terrace	Walled Plaza	A.D. 1080	A.D. 1200	-	-	-
NA2076		Fort	-	-	-	-	-
NA4154		Fort	-	-	-	-	-
NA5145	Owl Fort	Fort	A.D. 1050	A.D. 1150	-	-	-
	Second Sink	Ballcourt	-	-	-	-	-
	Wupatki Road	Ballcourt	-	-	-	-	-

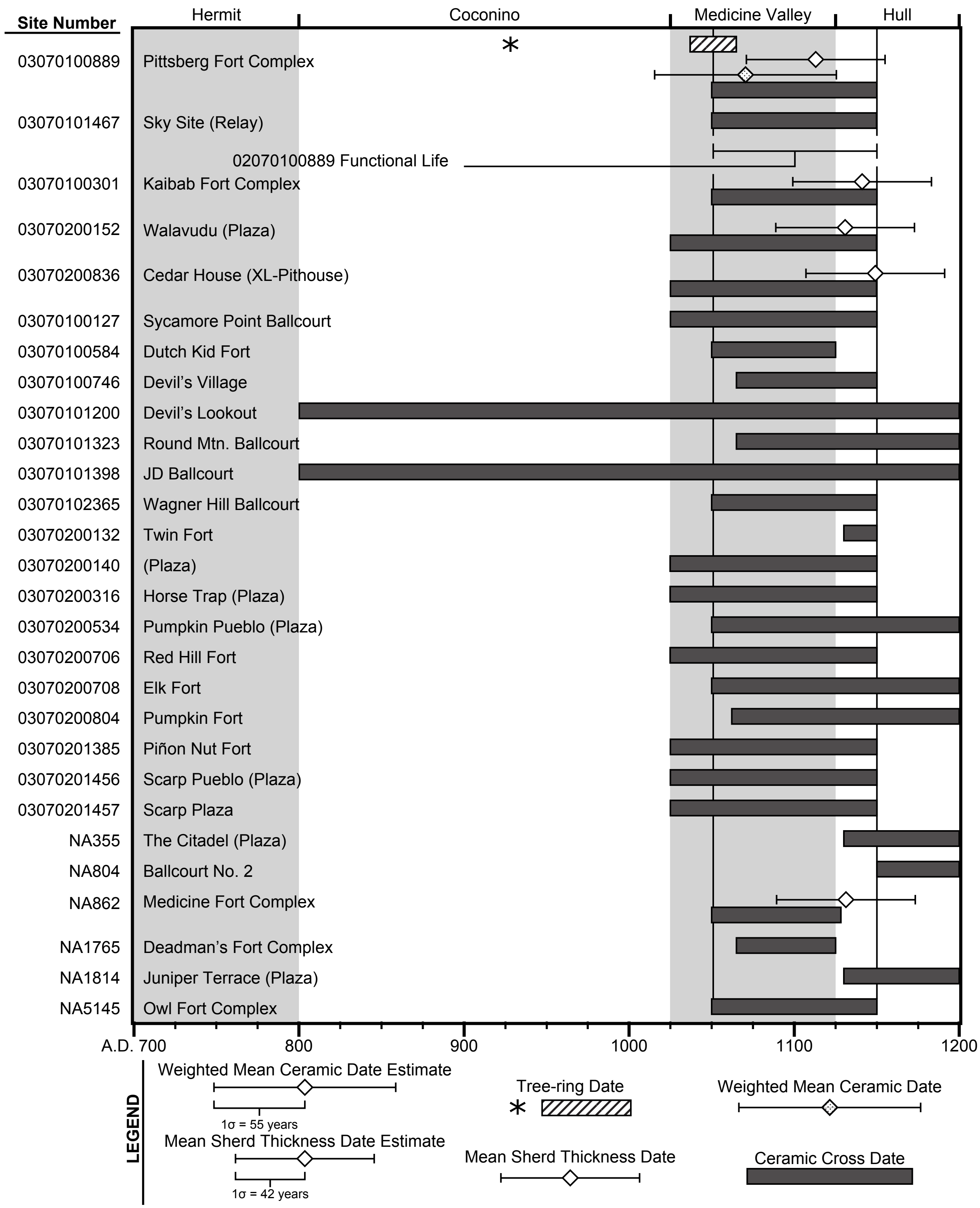

Figure 5.41. Temporal designations for known Cohonina public architecture sites.

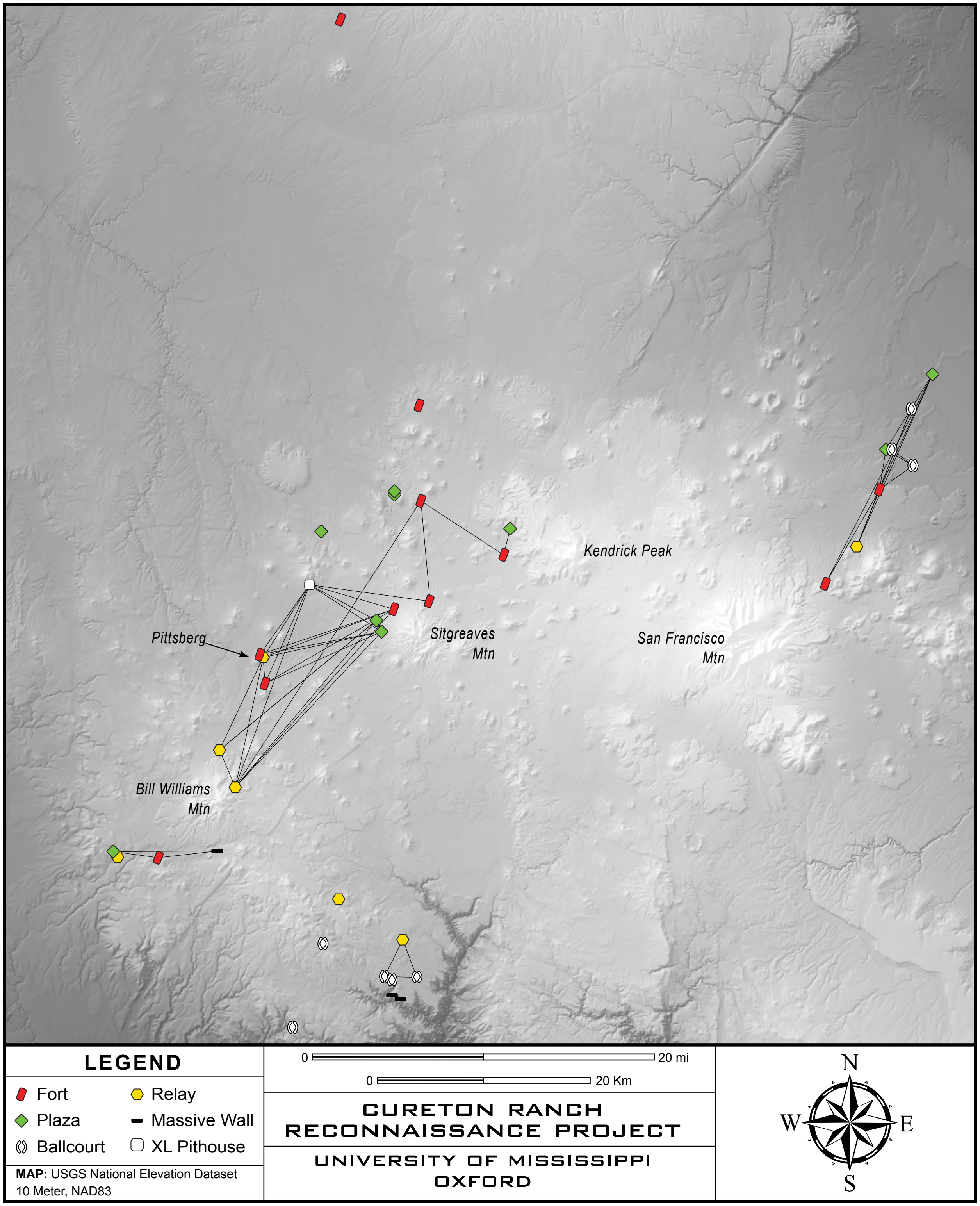

Figure 5.42. Revised line-of-sight network for Cohonina public architecture sites.

Summary

This chapter presented the results of survey, architectural studies, and GIS based spatial analyses. The Cureton Ranch Reconnaissance Project successfully completed a total settlement systems survey around The Pittsberg Fort Complex (NA3577, 03070100889). The results of that project formed the basis of subsequent analyses that described how many sites and of what kind makeup the Pittsberg settlement pattern and how the structure of that settlement pattern changed through time. Those analyses revealed the Pittsberg Community was likely founded in the late Hermit phase and persisted to the middle of the Hull Phase. These efforts also established a working model of the Pittsberg Community's boundaries. It was during the Medicine Valley phase that the Pittsbergers constructed integrative facilities within the boundaries of their community in the form the Pittsberg Fort Complex and Sky Site. These places are centrally located within that settlement system and an in depth analysis of Cohonina forts revealed they were built environments meant to be loci of intra-community secular and ritual activities. The results of visibility and slope analyses demonstrate conclusively the Cohonina of Pittsberg intentionally created line-of-sight connections between their and other community's integrative facilities; meaning the Pittsberg Fort Complex also functioned as an extra-community integrative facility. The final step to the functional analysis, including visibility analysis, of Cohonina forts is interpretation; that is attempting to pin down the meaning behind the actions. That effort is taken up in the final chapter.

CHAPTER 6: A NEW FUNCTIONAL THEORY OF COHONINA FORTS

The question posed at the beginning of this study was basic: What exactly was the function of sites Cohonina archaeologists call "forts"? In this chapter I use the results of the Cureton Ranch Reconnaissance Project and subsequent analyses to answer that question and develop a functional theory of Cohonina forts. In Chapter 3 we learned the entrenched defensive theory of Cohonina forts has been on shaky ground since Gladwin's (1943, 1944) critique of Hargrave's (1933) reconstruction of Medicine Fort. In this chapter I intend on laying the defensive theory to rest for good. The following critique shifts support to the theory that Cohonina fort sites were actually integrative facilities and thus loci of civil interaction rather than interaction mediated by a sharp stick.

The Defensive Theory of Cohonina Forts

In Chapter 3 we learned the entire defensive theory of Cohonina forts is traceable to Hargrave's analysis and subsequent defensive interpretation of one structure at one site (NA862, Medicine Fort). This defensive interpretation of NA862 rests on five lines of evidence, which even when considered in aggregate, do not support a defensive interpretation for that site or for ones similar to it. First, Hargrave pointed out NA862 is elevated above the surrounding landscape which Colton (1918) had argued earlier at other sites was evidence of defensively minded individuals seeking to build fortified refuges. Elevated positions do confer a defensive advantage against attackers (Rice 2001:300), but a site's elevated position does not in itself demonstrate defensive intentions. Second, the builders of NA862 allegedly restricted access to that building by positioning it on the edge of a steep sided sink. However, this position only restricts access from the west, while the eastern, northern, and southern approaches all provide more or less open access with the steepness of the approach being the only restricting factor. Hargrave attempted to correct this flaw in his argument by suggesting a double parapet wall staffed by archers on the east side of NA862 could neutralize threats on that side. However, this still leaves the northern and southern approaches open to attack. When one considers the site as a whole with its unprotected extra-large pithouse (NA1680), and longroom (NA1239) it appears as though the area was decidedly open rather than enclosed. Thus Hargrave was hasty in suggesting access to NA862 was restricted, especially when one contrasts that site with others exhibiting enclosing walls and single points of ingress/egress positioned at the edges of high cliffs, such as Indian Peak Ruin in central Arizona (Wilcox et al. 2001:145).

Hargrave was also certain that NA862 was immediately adjacent to water at the time of its use, but did not point to any potential locations. Water is, of course, a critical strategic resource for a group of people seeking to fortify and repulse attackers, but there is a decided lack of evidence to suggest NA862 was located immediately adjacent to such a source. The only plausible candidate is the sink immediately west of the site, but it apparently does not hold water.

Colton had earlier proposed exceptionally thick walls indicate a defensive function for structures and NA862 did indeed have very thick walls. However, its thick walls could have been intended to increase the building's thermal efficiency, or they may been an example of grandiose architecture (see Chapter 5). As with elevated positions, the presence of thick walls do not in themselves support a defensive interpretation. In addition, there is no reason a defensive site should have exceedingly thick walls unless its builders intended on constructing walls of great height, adding breast works and a firing platform, or anticipated an attack utilizing some sort of siege engine meant to batter walls into oblivion. To the author's knowledge, Pueblo II people of the Colorado Plateaus did not do any of these things besides occasionally building impressively tall walls, which the builders of Medicine Fort did not do. Therefore it appears the fixation on thick walls might have more to do with inadvertently projecting Eurasian military tactics and archetypes of castles and fortresses onto the archeological record of Northern Arizona than with any actual defensive advantage conferred by such an architectural characteristic for its time and place.

Hargrave also argued the evidence of food and water storage at NA862 supported his defensive interpretation, but equifinality rears its head again here as well. NA862 does in fact have considerable evidence for the storage of food staples and possibly water, but this could be attributable to a range of social processes such as community surplus storage, individual aggrandizers seeking to consolidate social power through the manipulation of material wealth, to storage in anticipation of integrative performances involving feasting. The final line of evidence Hargrave put forward in support of his defensive interpretation, and the one he relied most upon, was his architectural reconstruction of NA862 which involved *portales* roofs, parapets, and loopholes. All of these alleged architectural features at NA862 turned out to be pure speculation on the part of Hargrave and thus must be dismissed out of hand in the absence of any supporting evidence whatsoever.

Every line of evidence Hargrave (1933) and Colton (1939, 1946, 1960) put forward in support of their defensive interpretation of NA862 is untenable, making their defensive theory of Cohonina forts as a whole thusly unravel. However, this is not to say that violence and warfare did not occur during the Pueblo II period or people in the Northern Southwest were not building defensive installations because they clearly did (Hass and Creamer 1993) and warfare did play a major role in social interaction during that period (Turner and Turner 1999, Rice and LeBlanc 2001). What the collapse of the defensive theory of Cohonina forts does say is that the primary function of these sites was never intended to be defensive in nature. If perchance the Medicine Fort Complex and sites similar to it were intended to be defensive installations, they were poor ones that ultimately failed. In Chapter 5, I described how three of the four excavated fort complexes burned to the ground. If we take this as evidence of conflict or warfare, then these sites were evidently overrun and destroyed. This might have actually been the case when one considers the frequency of burned structures and violence in the immediate vicinity of the Medicine Fort Complex (Colton 1946; Turner and Turner 1999; Garcia 2004; Elson 2011). If the Medicine

Fort Complex suffered a similar fate as its domestic contemporaries, which no one consider to be fortified, then its position on the landscape and its architectural qualities did not confer to it any extra defensive advantage relative to neighboring sites if and when they came under attack.

Now that the defensive theory of Cohonina forts is refuted and set aside we find ourselves faced with a problem of definitions and classifications that has dogged this dusty corner of Cohonina archaeology since the beginning. Cartledge (1986) doubted the defensive theory and suspected it had led archaeologists to classify a range of Cohonina sites as “forts” that may have had very different functions. Bone (2002) found support for the fort class of Cohonina architecture when he did not find any significant differences between forts located in the Cataract Creek watershed and those located in the Verde River watershed, but he declined to examine site function being content to merely accept that architectural classification at face value. However, when I compared the gross architectural features of all known Cohonina forts, which included the set of four forts for which excavation data exist, I found little difference between the set of four excavated forts, but significant architectural differences within that architectural class as a whole.

When we use the set of four excavated forts to narrow our definition to those Cohonina sites exhibiting very large, roofed and exceptionally thick-walled masonry structures with a rectangular floor plan, having one doorway, at least two fire areas positioned at opposite ends of the building, and accompanied by one or more large pithouses and a longroom; we find that some sites classified as Cohonina forts do not meet the defining criteria. For example, Remley (1989), Wilcox (1996), and Bone (2002) all classified Site 03070100906 located south of Bill Williams Mountain as a Cohonina fort. However, on closer examination this site lacks all of the defining characteristics of a Cohonina fort. Site 0906 is positioned on top of a small mesa and consists of several sections of wall built along the mesa’s cliff edge where access from below is easiest. There are very few artifacts at the site and no ceramics, which precludes assigning the site to any cultural or temporal designation. This site resembles very closely those sites sometimes classified as “refuges”, “lookouts”, or “relays”, but not Cohonina forts. In fact a stronger argument could be made that Site 0906 had a defensive function than any of the four excavated Cohonina forts. Thus the previously mentioned researchers may be correct in viewing Site 0906 from a defensive stand point, but they were wrong in classifying it as a Cohonina fort.

This problem of the Cohonina fort concept capturing too much architectural variation came up again when I examined the enclosed space of Bone's Cohonina fort sites and the set of four excavated Cohonina fort sites. Outliers in those measurements indicate either Bone's calculations are flawed for some sites, or those outlier sites are not Cohonina forts as defined above and instead are something altogether different. It is now apparent the "fort" class of Cohonina architecture is masking architectural and likely functional variation. It is also clear that the sites called Cohonina forts as defined above do not belong to a military class of architecture while some sites, such as Site 0906, might actually be defensive installations. All of this begs the question of what sites archaeologists should label as "Cohonina forts"? The pragmatic answer would be to jettison "fort" as an operational term altogether and use more appropriate labels informed by a careful application of middle range theory. However, "fort" as a descriptor is hopelessly entrenched in Cohonina archaeological discourse despite several attempts to jettison it. There is a temptation to force some new ethnographically informed label onto the kinds of sites that are the focus of this thesis such as "lodge", "long house", or dare I say "kiva". But taking such action risks falling into the same conceptual trap that Hargrave and Colton built for themselves because it projects a set of behaviors into those spaces that may or may not have actually occurred there. Therefore we must begin at the beginning and determine what actually went on at the places we call Cohonina forts before we apply a new label to them, one that will inevitably carry with it an array of functional inferences.

A New Functional Theory of Cohonina Forts

Constructing a new functional theory of Cohonina forts requires a series of steps that link the archaeological and ethnographic records. The first step involves building a narrow definition for a class of architectural remains readily identifiable on the landscape and distinguished from other architectural manifestations based on a set of clear criteria. The preceding exercise, which drew on the gross architectural analysis of Chapter 5, accomplished that first task. The remaining tasks involve identifying those sites which meet that narrow definition, understanding their position in the larger Cohonina settlement system, and describing exactly how those places were used in the past. Finally, these inferences must be linked to ethnographically known behaviors via analogy or homology.

Site Structure Analysis

Broad scale settlement systems survey conducted by, or on behalf of, the Kaibab National Forest singles out fort complexes as probable integrative facilities. The Cureton Ranch Reconnaissance Project performed the first complete settlement survey around one of these complexes at Pittsberg and subsequent site structure analyses revealed the complex of structures that make up the Pittsberg Fort Complex are not repeated in kind or quantity elsewhere in the surrounding settlement pattern. On a broader scale, fort complexes, plaza sites, ballcourts, extra-large pithouses and their surrounding settlement clusters form a pattern of repeated elements that map onto the bigger hills and mountains of the Coconino Plateau. Settlement systems analyses conducted at Sitgreaves Mountain (Cartledge 1979; Samples 1992) and Pittsberg (this thesis) demonstrate conclusively these elements are the remains of relatively discrete Cohonina communities possessing their own integrative facilities. These communities are defined by a central integrative facility surrounded by household groups which in turn are surrounded by a constellation of logistical sites. Settlement fall off between settlement clusters defines probable social boundaries between communities.

Intra-community Integration and Interaction at Fort Complexes

Adler's (1989) ethnographic survey of non-ranked, at least partly sedentary societies, found the size of a community determined in large part the size of its integrative facility, the types of behaviors that occur at them, and the degree of formalization of space and ritual. These discoveries set up several expectations for Cohonina integrative facilities. First, evidence of some kind of prepared space specifically intended for integrative use should be present. The previously mentioned site structure analysis singles out several candidates, including fort complexes. The Pittsberg Fort Complex represents a considerable investment in place for a local community composed of, at most, seven households. The large floor plan of the fort and its exceptionally thick walls along with the great size of the pithouses all speak to a broader community effort focused on creating a unique space within the Pittsberg community wherein rituals of integration were meant to occur, such as ritually embedded exchange or feasting.

Adler's cross-cultural survey also found that a range of activities occur at the integrative facilities of small communities within societies of the kind the Cohonina most likely were. These activities range from the ordinary and mundane to the peculiarly sacred and ritualized. The analysis of floor assemblages at the Pittsberg Fort Complex confirms these expectations. The Cohonina at Pittsberg made ceramic vessels, spun yarn, and processed and stored food at the Pittsberg Fort Complex, while a similar range of mundane activities also occurred at Medicine Fort. Food processing and storage occurred more frequently than the other activities, suggesting Cohonina fort complexes, or more precisely forts themselves, acted as community food banks or granaries.

Floor assemblage data also suggest ritual activities occurred at fort complexes. While it is possible that the preparation and storage of food could have been carried out in a ritual context at fort complexes, the current data cannot support such an inquiry. However, the presence of items widely believed to have had magico-religious functions at the Pittsberg Fort Complex suggest it was a context for ritual performances more often than it was a context for more mundane activities. Data from the three other forts for which excavation data exists support this view. Thus a picture of intra-community Cohonina interaction and integration emerges wherein the members of small Cohonina communities gathered at fort complexes to carry out domestic activities, add to the community's food stores, and to act in or observe ritual performances.

The floor assemblage data also reveal some aspects of gender relations and access to public space in Cohonina society. If the theorized historical connections between the Cohonina, the Western Anasazi, and hence the Hopi hold up, then fort complexes were open to both women and men. Maize flour production amongst the historic Hopi was almost wholly the domain of women (Kennard 1979) and the presence of food grinding implements at fort complexes means women had open access to those places. Yarn production and weaving were men's work amongst the Historic Hopi (Kennard 1979) and the occurrence of spindle whorls at fort complexes suggests that men shared those spaces with women. Finally, pottery production was the domain of women at the historic Hopi Pueblos (Whiteley 2004:154) and the presence of pottery production tools at Pittsberg Fort further supports the inference that women had access to fort complexes. Our picture of Cohonina intra-community interaction and integration comes into greater focus given these data. Fort complexes were integrative facilities open to the whole community.

Inter-community Integration and Interaction at Fort Complexes

During the Medicine Valley phase Cohonina communities built an array of public edifices which incorporated intentional visual connections. These integrative facilities were built in relatively flat places that ensured high visual redundancy with other integrative facilities. A single community in the line-of-sight network (LOSN) could have received visual signals emanating from a multitude of other communities.

The presence of relays within the LOSN is interesting for two reasons. First, their presence suggests the communication network developed rapidly. The Sky Site within the Pittsberg settlement system creates a visual relay between the Pittsberg Fort Complex and the Kaibab

Fort Complex. The former fort complex produced an earlier Mean Sherd Thickness date than the latter, tentatively suggesting the members of the Pittsberg Community had to build the Sky Site relay in order to extend their visual communication network to the relatively new Kaibab Fort Complex. Second, these relays might have created "cut-points" in the LOSN, or nodes that when removed split the network. For example, the Pittsberg Fort Complex would not be able to intercept signals emanating from points south if the Sky Site relay at the Pittsberg Community was not manned. However, signals could be relayed through the Sitgreaves Community integrative facilities, but this would result in decreased communication efficiency and increased signal corruption. There are currently nine isolated nodes in the proposed communication network. However, the author suspects these isolates are the result of inadequate survey coverage or misplotted sites rather than a flawed LOSN.

Another interesting feature of the LOSN is the variation in the numbers of connections each class of public architecture has. Fort complexes have the most visual connections (26) while massive wall segments have the least (2). The latter suggests Wilcox's (1995) massive wall segments did not function as nodes in the LOSN. Plaza sites trail behind fort complexes with 20 visual connections while ballcourt sites share eight connections and the single extra-large pithouse in the LOSN has eight visual connections. By comparison the Pittsberg Community had nine visual connections to other communities between its two public architecture sites.

The ability of individual communities to communicate with each other via visual signals emanating from their integrative facilities, to engage in landscape surveillance, and to maintain high degrees of visual redundancy were important aspects of the Cohonina LOSN. Line-of-sight communication networks have been interpreted as components in polity wide defensive strategies that alerted communities to hostile incursions as well as providing a means to mass an armed response to such hostile actions (Haas and Creamer 1993; Wilcox et al. 2001; Swanson 2003). However, a LOSN can only be interpreted as military in nature if the sites that serve as nodes in the network exhibit strong evidence of fortification and those sites are related to defensively minded communities. Cohonina integrative facilities were not fortifications and their communities were dispersed rather than concentrated and fortified; meaning the Cohonina LOSN's primary function was not military in nature. Thus we must look to other social processes to determine the primary function of the Cohonina LOSN.

An alternative explanation for the function of the Cohonina LOSN is that it was part of a regional ritual exchange system connecting the various Cohonina communities. The presence of public architecture sites connected by lines-of-sight at every known Cohonina community indicates that either there were strong social obligations in play that required each community to participate in the LOSN or that each community stood to benefit greatly through their participation in that network. If ritual exchange underlies the Cohonina LOSN then both motivating factors would have been in play. Plog (1989) made the argument that small more or less sedentary and socially related communities on the Colorado plateaus could not have survived autonomously in their restricted areas because they would be unable to recover from even a few years of bad returns from their local subsistence economy. This basic material reality resulted in the evolution of more formalized social boundaries and networks of obligation in resource/information exchange that were regulated by ritual conducted in formalized spaces (Plog 1989:146). These ritual exchange networks structured the flow of commodities and information through far-flung communities that at once ensured the survival of those communities, masked inequalities in exchange, reduced conflict, promoted social solidarity, and by extension acted to stabilize a set social relations prone to disassociation and conflict.

Cartledge (1986) anticipated Plog's argument when he argued that an exchange network linked far-flung Cohonina communities, providing each access to commodities unavailable in their restricted resource catchments. The Cohonina LOSN revealed during the course of this thesis could have provided the means to schedule and coordinate ritual exchange between communities. For example, if the members of the Pittsberg community wanted to host a ritual performance at their fort complex, they would have signaled their intention to the other communities in their visual network with smoke or fire. Observers at nearby communities would have recognized the signal as emanating from Pittsberg and then passed the announcement on to other communities out of the Pittsbergers visual range and theoretically all the way to the frontiers of the Cohonina regional system. Community representatives would then gather at the Pittsberg Fort Complex to engage in exchange of commodities and information embedded in a ritual context. This hosting of inter-community ritual exchange could help to explain the size of Cohonina forts, which appear to be larger than what is needed for the communities that built and maintained them. Participation in the ritual exchange system could guarantee the Pittsbergers access to commodities and information unavailable locally while reinforcing the web of social relations and obligations that linked more or less autonomous social segments.

The foregoing discussion provides support to the idea that the Cohonina LOSN identified during the course of this thesis served a primarily integrative function. However, it is unlikely the Cohonina used their LOSN solely for that purpose. The LOSN is, at its most basic, a communication system and there is no limit to the informational content that could be transmitted through it. Therefore it is probable that the LOSN was used for a multitude of communicative purposes such as coordinating economic activities between nearby communities or possibly as a means to quickly mass a military force against a belligerent group either from within or without the Cohonina regional system. In sum, inter-community integration and interaction was the primary purpose of the Cohonina LOSN, but it could have and probably did serve other communicative needs on occasion.

Ramifications for Models of Cohonina Regional Interaction and Integration

The new theory of Cohonina fort complexes just presented posits they were substantial built environments wherein mundane and ritual behaviors were enacted to integrate Cohonina society at multiple scales. At the intra-community level fort complexes were considerable investments in place that acted as communal spaces for storage, gathering places for ritual exchange of commodities and information enactments, ritualized manipulation of prestige items, and places to carry out more mundane activities such as yarn spinning and meal grinding. At the inter-community level fort complexes functioned as nodes in a visual communication network linking separate Cohonina communities. Fort complexes, plazas, ballcourts, extra-large pithouses, and relays all shared visual connections, suggesting these places were functionally equivalent nodes in that network. These findings make it possible to reassess the models of Cohonina social organization that have so far been proposed.

The Mobility Model

The Mobility Model of Cohonina social organization argues these folk organized themselves as small, autonomous bands that roamed around the Coconino Plateau, moving from one resource patch to another in a bi-seasonal round. The accumulated body of knowledge on Cohonina settlement and subsistence, and the results of this thesis do not support this model of Cohonina social organization. On the contrary, Cohonina communities coalesced in areas of Piñon-Juniper woodland that enjoyed higher precipitation relative to other parts of the plateau. These areas coincide with the bigger hills and mountains of the plateau since elevation is the major factor determining precipitation on the plateau. Outside of these "prime" areas the Coconino Plateau provides its occupants meager succor. The vast ponderosa forests of the plateau occur in areas of greater precipitation, but these forests are too high in elevation to support agriculture and are resource poor relative to the Piñon-Juniper woodland. The historically expansive grasslands of the central plateau harbored an abundance of wild game, but these wind blasted vistas are too dry to support anything more than transient visitations.

These ecological conditions channeled the incipient agriculturists known as the Cohonina onto the slopes of hills and mountains where the right combination of adequate moisture, growing season length, and access to wild resources existed. The Pittsberg settlement system chronicles this process from the founding of a small community as early as the late Hermit phase through its maturation and on to its decline in the middle Hull phase. Throughout that

350 year history, there was a perennial presence at Pittsberg and the settlement data indicate the Pittsbergers did not travel far to engage in activities of economic production. The Cohonina of Pittsberg also did not have to travel to engage in activities of community integration when they built a fort complex within their community at about A.D. 1053. This considerable investment in place which includes the Pittsberger's long term residential commitment to their hill and especially their construction of the Pittsberg Fort Complex directly contradicts the Mobility Model. The Cohonina at Pittsberg committed to a sedentary lifestyle on the slopes of Pittsberg for the better part of four centuries. The fort complex with its stores of food and ritual items anchored that community to Pittsberg while at once providing an overt symbol of that community on the landscape.

The Mountain-centric Model

The Mountain-centric Model of social organization argues the Cohonina organized themselves as small relatively autonomous sedentary communities occupying the bigger hills and mountains of the Coconino Plateau. The model also predicts exchange networks supported a Cohonina political economy which provided the means for Cohonina communities to ensure their survival in the face of localized commodity shortages, as well as the means to participate in a wider Cohonina social system. The preceding comments on the Mobility Model demonstrate conclusively that the accumulated facts of Cohonina settlement and subsistence support the Mountain-centric Model; that is the Cohonina were sedentary folk living in small communities in the shadows of hills and mountains on the Coconino Plateau. Data from the Pittsberg settlement system also support the Mountain-centric Model. The presence of habitation, logistical, ritual, and integrative sites within that settlement system indicate it was a fully fledged community capable of providing itself the majority of the resources it needed for survival as well the public spaces needed for rituals of social integration. The presence of substantial masonry and jacal structures suggests the members of that community were capable of maintaining residence at Pittsberg year-round which includes winters that regularly achieve sub-zero temperatures. In short, community level bi-seasonal mobility is not required to account for the archaeological record around Pittsberg. Although Pittsbergers undoubtedly left the bounds of their community on trips for exchange or otherwise, the data overwhelmingly indicate someone was always home.

The inter-community line-of-sight communication network described above could have provided the means to structure interaction and the flow of information and commodities between communities, exchange that Cartledge (1986:110) saw as critical to the maintenance of Cohonina society. Plog (1989) made a similar argument but pointed out that exchange by itself does not result in greater social integration. In order for exchange to increase social solidarity it must take place in a ritual context. The Cohonina public architecture system would have provided the space and symbolic system to meet and negotiate the exchange of information and commodities in a ritual context. This proposed ritual exchange network remains to be attested in the archaeological record. Luckily, Shackley (2005:169-171) has already laid the groundwork for how such an inquiry might be carried out. In his investigation of Hohokam gender relations he found evidence that projectile points made of Government Mountain obsidian and executed in Cohonina styles (if not whole arrows) were being exchanged via the ballcourt system within the Phoenix Basin. If we suppose as Shackley does that this exchange was ritually embedded, then the high incidence of projectile points at fort complexes might be evidence of ritual exchange at those integrative facilities. Needless to say much work remains to be done to bear this hypothesis out, but the data at hand are certainly provocative.

The Mountain-centric Model and Segmentary Organization

The Mountain Centric Model fits very well the broader anthropological model of segmentary organization and horizontal complexity. As it turns out segmentation is the more common way for larger human social groups to organize themselves (Sahlins 1961) as opposed to hierarchical social structures relying on organic solidarity. The ecology of the Coconino Plateau precluded Neolithic incipient horticulturalists from aggregating into large towns and created a situation wherein more or less autonomous communities dotted the landscape. These communities were structurally and functionally identical divisions of the social landscape because they maintained their own residences, resource catchments, and most importantly, they maintained their own integrative facilities. However, the ecology of the Coconino Plateau also meant these community segments could not survive completely autonomously and therefore some system of exchange and integration made reliable by ritual must have existed.

Rice (2000), in an examination of Hohokam social organization, identified a set of ecological preconditions and archaeological phenomena that should be evident if a segmentary social structure had existed in the Phoenix Basin south of the Coconino Plateau during the Classic period (A.D. 1150 to 1450). First, the ecology of the area in question must necessitate a commitment to territory by human groups if they want to survive and thrive. The basic materials and conditions conducive to human survival must occur in limited areas. In addition, the mode of production utilized by human groups to extract those resources must necessitate a long term commitment to a particular locality. This kind of situation creates a human-landscape relationship wherein members of a settlement must maintain control of one of a limited number of productive niches in order to ensure their survival, resulting in a de facto form of land tenure and territorial control (Rice 2000:154).

Ecological conditions on the Coconino Plateau meet this precondition. Piñon-juniper woodland is the only biotic community on the plateau capable of supporting a mode of production based on heavy wild resource collecting coupled with Neolithic horticulture. Access to piñon nuts, water sources, soils suitable for maize production, areas of adequate precipitation and growing season length were the primary considerations the Cohonina weighed when they founded communities (Cartledge 1986; Schubert 2008). The intersection of these ecological factors occurs in a limited number of areas on the Coconino Plateau which happen to coincide with the lower slopes of the major hills and mountains. Cohonina communities were obligated to make long term commitments to these locations for a number of reasons. First control of piñon pine groves was likely a major concern and limited inquiries into piñon nut production (Jeffers 1995) indicate that yields can be improved in individual stands through judicious culling to select for heavy seed producing trees, planting seeds retrieved from heavy producers, and the removal of juniper trees from piñon nut stands. This would have been a multi-decade process necessitating a commitment to territory. Second, areas suitable for maize production are more limited on the plateau than piñon nut stands, which created even greater incentives to claim and control those areas. Control of productive areas could only be achieved by maintaining a perennial presence, further reinforcing the need to make long term commitments to territory.

Rice (2000:156) termed his second precondition for the development of segmentary organizations "commitment to neighbors". This describes an economic situation wherein the use of the landscape encourages cooperation between neighboring communities, less so for moderately distant communities, and so on until there is no incentive for cooperation beyond a certain distance. This is similar to Sahlins (1961:331) "segmental sociability" and once again the distribution and ecology of piñon nut grooves on the Coconino Plateau provides the basis for cooperation. In order for a Cohonina community to ensure its survival it had to protect its piñon nut harvest from intruders. The likeliest perpetrators would be members of an adjacent community, necessitating a system of strong sanctions in response to illegal collecting in order to maintain peace between communities. However, the need to keep the peace and the threat of reprisal for illegal collecting would both diminish with distance, opening up the possibility for illegal collecting far from one's own community. Illegal collecting in your neighbor's piñon nut stands would also reduce the chances they would come to your aid in the event your own community's stands suffered a poor yield, which occurs somewhat often (Janetski 1999). Thus the best strategy would involve neighborly cooperation and coordination between proximate communities coupled with occasional illegal collecting in stands maintained by distant communities.

Ecological preconditions for the development of Neolithic segmental organizations are present on the Coconino Plateau which sets up certain expectations for the structure of settlement systems and the incidence of integrative facilities. First, the overall regional settlement system must exhibit site clustering that can be interpreted as "settlement complexes" or the remains of relatively discrete communities separated by zones of settlement fall off. Second, if integrative facilities are a feature of social integration, then settlement complexes at a comparable level of inclusiveness must all contain integrative facilities if one does. In other words, if integrative facilities are present in the settlement system, then each community must have its own facility because segmental organizations by definition must be composed of economically self sufficient and redundant social segments in terms of structure and function.

Rice (2000:158) identified two ways the distribution of integrative facilities in a segmental organization might manifest. Integrative facilities might cluster in one location with the number of facilities reflecting the number of participant social segments. The Sitgreaves settlement complex might exhibit evidence of clustering as a result of settlement amalgamation. There are four examples of community level integrative facilities (2 plazas sites and 2 fort complexes) which might indicate four social segments occupied the slopes of that mountain. Integrative facilities may also manifest as single occurrences within discrete communities. The relationship between the Pittsberg settlement complex and the Kaibab settlement complex illustrates this situation well. Each complex represents the remains of a more less discrete community that contained one community level integrative facility in the form of a fort complex. However, Rice (2000:159) cautions that this latter form of integrative facility distribution requires the investigator demonstrate they were integrated into a wider organizational structure otherwise their incidence on the landscape could be interpreted as a set of completely independent systems. Fortunately, this is readily demonstrable in the Cohonina region because a line-of-sight communication network connected spatially discrete integrative facilities like those at the Pittsberg and Kaibab communities.

The accumulated body of archaeological knowledge on the Cohonina suggests their social structure was segmentary in nature and defined by horizontal rather than vertical complexity. This realization sets up several expectations in terms of how fort complexes and other integrative facilities fit into the wider Cohoninan political economy. First, Cohonina integrative facilities must not exhibit evidence for the control of long distance trade, economic redistribution, or economic production (Rice 2000:157). Instead, these places should exhibit evidence that they functioned as forums for ritual enactments and the display and manipulation of ritual/prestige items such as imported Kayenta pottery, jewelry, fetishes, and arrows. Mills (2004) produced a compelling study of ethnographic and archaeological Puebloan prestige items to show how those items might have been articulated into a coherent assemble of "inalienable objects" such as ritual costumes.

The evidence amassed for fort complexes suggests they functioned as predicted. However, their role in the proposed ritual exchange system must be reconciled with the expectation that these places did not aid in the control of production and exchange. This might not be an intractable problem because the data suggest fort complexes may have aided in the coordination of exchange without necessarily controlling it. There is no evidence to suggest that a single Cohoninan or coalition of Cohoninas were using fort complexes to amass wealth in an attempt to control some aspect of the political economic system. Instead the accumulations of economic and non-economic goods found at fort complexes are sufficiently large for consumption by the fort complex's community only. Going back to Mills' (2004:240) study of inalienable objects, we find that ritual objects can be used to promote communal identities and the reaffirmation of a segmented power structure.

A segmentary model of Cohonina society also sets up several implications having to do with how the individual segments of Cohonina society interacted and how those segments or Cohonina society as a whole interacted with "outsiders". The first implication is that interaction between Cohonina social segments might have been structured by complimentary opposition. Although not all segmentary organizations are structured by the principle of complementary opposition, certain ecological and cultural preconditions might favor its development. These conditions were in play during the Formative period on the Coconino Plateau, suggesting that complimentary opposition as a structuring principle might have been integral to Cohonina regional interaction and integration. Sahlins (1961) and Evans-Pritchard (1940) before him pointed out that complimentary opposition acts as a political machine driving relations between segments and between outsiders:

> …segmentary sociability materializes in complementary opposition, the massing of equivalent segments in defense or extension of their respective privileges. In any opposition between parties A and B, all those more closely related to A than to B will stand with A against B, and vice versa. Segments are pitted against equivalent segments: any opposition between groups (or members thereof) expands automatically to opposition between the largest equivalent lineages of which the contestants are respectively members. The massing effect is self-limiting as well as self-expanding. It cuts off when sibling groups are joined because lineages equivalent to the inclusive one containing opposed sibling groups are equally related (or equally unrelated) to the contestants. [Sahlins 1961:332]

Complimentary opposition acts as a governor between neighboring social segments, ensuring peaceful interaction and speedy resolution of conflict because the specter of the massing effect automatically making a fight between the smallest social segments (Cohonina communities like Pittsberg for example) a fight between major social segments (aggregates of Cohonina communities for example). Finally, Sahlins (1961:336) argued that segmentary lineages are social organizations of predatory expansion because they direct structural tensions outward in a centrifugal effect manifested as migrations and hostile incursions into neighboring territories. That old workhorse, *The Nuer* (Evans-Pritchard 1940), illustrates this process clearly. Because hostility was always directed towards the most distantly related social segment, the Nuer as a polity were perennially engaged in predatory expansion against their Dinka neighbors. This process might stand to reveal important aspects of Cohonina relations with their Cerbat, Kayenta, and Sinagua neighbors. If we accept the existence of a Cohonina-Sinagua-Kayenta shatter zone in the area of Medicine Valley (Colton 1946; Garcia 2004), then we have a tantalizing glimpse of how the segmentary Cohonina polity articulated with its neighbors. Pursuing the details of Cohonina segmentary organization and regional interaction is beyond the scope of this thesis, however the proceeding comments point to potentially fruitful paths for future research. Those paths appear as if they might be best illuminated by looking to African case studies, segmentary organizations, and heterarchies rather than those emanating from the Great Basin of North America or Polynesia (McIntosh 1999b).

Summary

This thesis sought to explore the specific functions and symbolic meanings of forts in Cohonina sociopolitical organization. An intensive search for those functions and meanings began with broad scale settlement systems survey that incorporated data nearly eighty years old, new survey conducted around Pittsberg, and the impressive and ever expanding settlement systems database maintained by the Kaibab National Forest. I conducted settlement systems analysis within a theoretical framework that sought to bring together the behavioral orientation of settlement archaeology and the cognitive orientation of landscape archaeology within a GIS based work environment. Those efforts were a success in that I was able to characterize in great detail the spatial and temporal context within which the Pittsberg Fort Complex existed. These findings created the launching off point to pursue the functional role of forts in Cohonina society. I was able to illuminate both the intra-community and inter-community functions of Cohonina forts by exploring their position on the landscape, their relationship to other site types, and the residues of past behaviors contained within their walls. Cohonina fort complexes were, beyond the shadow of a doubt, integrative facilities wherein members of small segments of Cohonina society came together to act as a community. These places also acted as visual symbols on the landscape that linked individual Cohonina communities into a cohesive social entity.

However, there are several shortcomings of this thesis. First, data maintained by the Museum of Northern Arizona is problematic. This thesis relied on excavation data that is nearly eighty years old, which because of that age has suffered many degradations. It quickly became apparent that archaeological data produced during the early period of Northern Arizona archaeology is still useful for contemporary research, but the work required to reconstruct the results of those efforts can be immense. Unfortunately, I was unable to completely reconstruct inventories, maps, and the like in the time I had to work on this thesis. However, we should not shy away from these tasks because sites previously thought to be totally exhausted of research potential (e.g. the Pittsberg Fort Complex) still stand to contribute to our understanding of Southwestern prehistory.

Another shortcoming of this thesis has to do with the realization that the “fort” label is masking morphological and likely functional variation in Cohonina architecture. Perhaps this could not have been known without performing the analyses carried out during the course of thesis. Regardless, if research into Cohonina fort sites is to continue future researchers must visit all those sites classified as forts and reassess them according to the narrowed definition proposed in this thesis. Unfortunately, this effort was beyond the scope of this thesis. A related challenge has to do with the actual locations of fort sites. During the course of viewshed and line-of-sight analysis I realized that sites misplotted by even a few tens of meters could produce spurious results. For example, the Kaibab Fort Complex was misplotted by about 20 meters in the Kaibab National Forest Database which excluded it from the proposed line-of-sight network despite my suspicions to the contrary. This prompted me to ask volunteers to visit the site and collect updated spatial information using a handheld GPS device. Those efforts revealed the error and indicated that site actually is included within the line-of-sight network. Misplotted sites might help to explain why some public sites appear as isolated nodes in the network.

One of the most exciting results of this thesis, at least in my opinion, is the possibility of developing a GIS based predictive model for locating unknown Cohonina integrative sites. It now seems apparent that Cohonina architects carefully sought to juxtapose the factors of slope and visual redundancy when deciding where to build an integrative facility, be it a fort, plaza, ballcourt, or relay. Given these findings, it now seems possible to cast our visual nets upon the landscape in order to model where unknown integrative sites are most likely to be. If one was to begin at the several isolated nodes in the proposed line-of-sight network, they might be able to find the missing links that could reproduce the entire regional network. However, it goes without saying much work needs to be done before such a model could be deployed successfully.

The goals of this thesis and my approach for achieving them were ambitious and far reaching, but the nature of the questions asked demanded that it be so. Attempting to gain access to the cognitive or the symbolic in the archaeological record is a tricky process indeed and one where it is frighteningly easy to impose one's own cognitive significance onto the archaeological phenomena under scrutiny. However, tests of intentionality stand to reign in the deleterious effects of unsubstantiated speculation. A broad scale settlement systems survey is a necessary first step in such an effort. Settlement systems survey provides the spatial, temporal, functional, and ecological data that act as powerful constraints on archaeological interpretation. It is only when these factors are understood that the archaeologist can make any attempt to access the symbolic systems of past peoples encoded in the material residues they left behind. Within Cohonina archaeology, none of this was possible until Sorrell (2005) solved the chronology problem when he developed Mean Sherd Thickness Dating for San Francisco Mountain Gray Ware. The results of chronological analyses conducted during the course of this thesis uphold the veracity of that method, results without which this thesis would have been a miserable failure.

Functional studies also rely on the precise excavation, mapping and inventory of artifacts and I owe a great dept to the excavators of the Pittsberg Fort Complex for having the forethought to carry out their excavations as they did. Had the likes of Lyndon Hargrave, Albert Schroeder, Walter Taylor, Robert Solenberger, Milton Wetherill, and their Hopi assistants not carried out the excavation of the Pittsberg Fort Complex so precisely, my functional analysis of Cohonina forts would not have been possible. Finally, GIS based analyses provide a powerful tool to approach cognitive aspects of the archaeological record, but they also provide ample opportunity to lose one's way in an ocean of analytical possibilities. I have gone to great pains to demonstrate that it is not enough to merely demonstrate the existence of some pattern in the archaeological record that might reflect symbolic action using GIS. Instead the archaeologist must seek out ways to test intentionality in those potentially symbolic patterns. This thesis represents just such an effort to find intention on the landscape, however modest it may be.

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LIST OF APPENDICES

APPENDIX A

Site Descriptions

This appendix contains site descriptions and maps for all sites encountered during the Cureton Ranch Reconnaissance Project. These descriptions include discussions of features when present and artifact types encountered along with count estimates. Special attention is given ceramic types, projectile points, lithic and groundstone materials present, and the stages of lithic reduction present. Chronological and functional assessments are also provided. Functional interpretations were made in Chapter 5 and the basis for temporal assignments given to Cohonina sites is covered in Appendix B. Site descriptions are presented in order by their Kaibab National Forest (KNF) site number. These site descriptions also discuss how Museum of Northern Arizona (MNA) sites recorded or excavated during the 1938 expedition were relocated where appropriate.

030700100237 is a previously recorded site. KNF site cards indicate it is a Cohonina, Coconino to Hull phase, Ceramic and Lithic Scatter. This logistical site is located at about 2,022m in elevation and is in Great Basin Conifer woodland. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the Northeastern flank of Pittsberg. This site has been impacted by erosion with surveyors encountering a small number of artifacts including one Deadmans/Floyd sherd and one tertiary flake of San Francisco Volcanics. Ceramic Cross Dating (CCD) dates this site to between the 9th and 10th centuries (A.D. 800-1200).

030700100238 is a previously recorded site. KNF site cards indicate it is a Cohonina, Coconino phase, Ceramic and Lithic Scatter. This logistical site is located at about 2,007m in elevation and is in Great Basin Conifer woodland. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the Northeastern flank of Pittsberg. This site has been impacted by erosion. Approximately 50 Deadmans/Floyd sherds are present representing perhaps one pot bust. Lithic types present include San Francisco volcanics and Kaibab chert. Mean Sherd Thickness Dating (MSTD) dates this site to the mid 10th century (A.D. 946 ± 42 years).

030700100239 is a previously recorded site. KNF site cards indicate it is an undated Lithic Scatter. This logistical site is located at about 2,036m in elevation and is in Great Basin Conifer woodland. This site has been impacted by erosion. Lithic types present include San Francisco volcanics.

030700100889
NA3577
The Pittsberg Fort Complex

REFERENCES: Hargrave (1938); Colton (1946:217-220; 1960); Robinson et al. (1975:15-16); Ahlstrom (1983); Downum (1988); Horn-Wilson (1997:120,122); Bone (2002); Adams (2002); Sorrell (2005); Shackley (2005).

030700100889 is a previously recorded site. KNF site files indicate it is NA3577, also known as the Pittsberg Fort. This integrative site is located at about 2,076m in elevation and is in Great Basin Conifer woodland. The Cureton Ranch Reconnaissance Project (CRRP) confirmed this association based on surface features present at the site. Museum of Northern Arizona (MNA) archives describe this site as a fort. MNA archives indicate the site consists of six structures (A through F) and one intrusive burial Site 00889 was recorded by Albert Schroeder on June 13, 1938 and excavated by the 1938 MNA expedition members led by Lyndon L. Hargrave. The CRRP completely remapped the site and succeeded in relocating five of the original six structures. Structure F was not relocated and no archival information exists to indicate what that feature is. MNA archives also suggest a Structure G was excavated, but no spatial information exists for this feature, short of one photgraph The CRRP identified an additional masonry feature (Structure H) situated at the base of small ledge north-east and down slope of Structure A. Dendrochronology dates the construction of this site to the mid 11th century (A.D. 1051 to 1053). MSTD dates this site to the early 12th century (A.D. 1113 ± 42 years).

Structure A (the fort) is large rectangular surface structure of un-shaped masonry set in mud mortar. Its exterior dimensions measure approximately 13m long and 6m wide. Its walls average approximately one meter thick. There is a one meter wide entrance on the east side of the structure towards its south end. Photographs taken during the 1938 excavation indicate Structure A had a clay floor. Several shallow depressions in the floor (exact location unknown) served as pot rests for at least four large storage jars. No information on the method of roof construction exists besides a floor plan map showing 11 post holes arranged in two roughly parallel rows. However, there is no reason at this point to suspect the roof was not constructed in a similar manner to that of the Medicine Fort (NA8626) (Hargrave 1933) or NA3852C (McGregor 1967b). The flat roofs of these structures were supported by posts, upon which rested cross beams. A layer of parallel small timbers were laid atop the cross beams which were in turn overlain by pine bark. Finally, the roof was topped with a substantial clay cap. At NA3852C, the roof was substantial enough to double as a work area and at NA862 the roof was substantial enough to at least stand on. Structure A had four fire pits, two each in the north and south ends of the structure.

Structure A contained an intact floor assemblage consisting of whole and crushed ceramic vessels, ceramic spindle whorls, ceramic discs, chipped stone items, manos and metates, projectile points, a variety of bone tools including awls, textiles, cordage, jewelry, a crinoid fossil, and food items. Ceramics recovered from this structure were predominately large storage vessels of SFMGW (number unknown but greater than four), but also included at least two Deadmans

Black-on-grey bowls and a Deadmans Gray jug (Hargrave 1938; Colton 1946; Downum 1988; Sorrell 2005). Downum (1988:360-361) provides updates to Colton's (1946) floor sherd counts.

Structure A produced a tight cluster of tree ring dates in the early 1050s A.D. with an early death date of A.D. 928 and a late death date of A.D. 1065 (Robinson et al. 1979; Ahlstrom 1983; Downum 1988). Colton (1946:218) suggests that Structure A experienced two building episodes beginning with a southerly masonry room. At some point, he argues the north wall of this room was removed and a northern addition attached. This inference goes back to Hargrave's (1938) published maps of the feature which show two dashed lines, presumably outlining the position of the removed wall. However, Colton does not provide supporting evidence for this argument and the CRRP could not find any evidence of two construction episodes during its remapping. Downum (1988:360) considers the early cutting date an example or reused wood or old wood. The tight cluster of cutting or near cutting dates in the early 1050s suggest the structure was built about A.D. 1053. The late cutting date likely represents a repair episode and the last secure date the structure was in use. Sometime after A.D. 1065 Structure A burned down. The presence of Winona Brown sherds from the floor indicates Structure A stood at least until A.D. 1080 (Elson 2011). The absence of Dogoszhi and Flagstaff Black-on-White, and Citadel polychrome suggest that the conflagration could have occurred as early as A.D. 1075, but no later than A.D. 1150. After an unknown period subsequent to the fire, an individual was buried within the now ruined structure. The burial party excavated through collapsed roof material and positioned the body on its side, in a flexed position, and well above the floor. The burial lacked any accompaniments, making it impossible to assign cultural affiliation to the individual or estimate the time of burial.

Structure BI-II is a long, narrow rectangular surface structure constructed of unshaped masonry and jacal. Its exterior dimensions measure approximately 10.5m long and 4.5m wide. The structure is divided into two rooms and lacks evidence of entryways. Very little archival information exists for this structure. Colton (1946:219) reports that the southerly Room I was built first, following by the northerly Room II. No mention is given to whether or not Structure B had a roof, but he does report no post holes were found. He also claims fire pits were found in both rooms. However, no detailed maps or photographs are known for this feature, making it difficult to assess the veracity of these claims. MNA archives list projectile points, bone awls, and a bone spatula as items recovered from this structure. Colton (1946:219) provides a list of ceramics recovered from the general provenience of the structure. A single non-cutting date of A.D. 1047 was recovered from Structure B. This single specimen of burned wood indicates only broad contemporaneity with Structure A and that Structure B burned as well.

Structure C is a large surface structure constructed of unshaped masonry, timber, and jacal. Its exterior dimensions measure approximately 10.5m long and 8.5m wide. The structure is divided into two rooms by a masonry and jacal wall and a doorway is evident in its northeast wall. Photographs of the structure indicate the interior walls were clad in mud plaster. Hargrave (1938:46) reports the structure had a "good clay floor" and plan maps indicate it had two fire pits positioned at each end of the southwestern room. Precise information on the method of roof construction was not recovered, but the abundance of beams in plan maps and existence of "roof clay impressions" in the MNA inventory suggest it had a substantial timber roof incorporating pine bark, clad in clay and supported by approximately 12 posts. Colton (1946:219) suggested the roof extended beyond the floor area, but does not explain why he thought so.

Structure C also contained an intact floor assemblage consisting of crushed ceramic vessels, ceramic discs, manos and metates, vesicular basalt cylinders, a polishing pebble, projectile points, a variety of bone tools including awls, textiles, and a basket. Ceramics recovered from this structure include at least two large storage vessels of SFMGW. Colton (1946:219) provides a list of ceramics recovered from the general provenience of the structure. A series of non-cutting dates indicate Structure C was in use until at least A.D. 1062 before it burned.

Structure D is a pit house structure constructed of unshaped masonry, split and un-split timbers, brush, and jacal. Its exterior dimensions measure approximately 6.8m long and 5.75m wide. The floor lies 40cm below the ground surface and was not well preserved. The walls were constructed of poles set in the ground, backed by split boards, followed by brush, and finally clad in clay plaster. The structure had a doorway on its northeast side. Ahlstrom (1983:12-13) described the roof of the pit house as substantial and supported by four to six posts. It incorporated "a lower layer of large poles spaced 15cm apart, a middle layer of split slabs of wood 5 to 15cm in width and 5cm thick, and a top layer of brush covered with clay" (pg. 12-13).

Structure D also contained an intact floor assemblage consisting of at least one Deadmans Gray jar, ceramic discs, chipped stone items, projectile points, and a bone awl. Downum (1988:362-363) provides updates to Colton's (1946:219) list of ceramics recovered from the general provenience of the structure. Two cutting dates of A.D. 1051 and 1053 indicate Structure D was built in the early 1050s and a non-cutting date suggests it was in use until at least A.D. 1058 before it burned.

Structure E may or may not be a small structure built of masonry. No detailed plan map exists for this feature and Colton (1946:220) suggested that its excavators may have uncovered the original ground surface rather than an architectural feature. Three projectile points and approximately 167 ceramic sherds were recovered from the feature. No dateable was recovered from Structure E.

Structures F and G are enigmatic. Very little information exists for these features. Published maps (Hargrave 1938:48) indicate Structure F is a large rectangular structure lying to the east of Structure D. The CRRP did not relocate this structure dispite an intensive search of the area. Structure G is known from a single photograph showing a partially excavated crushed vessel. This caption may be a typographic error and the photograph may actually be from one of the attested structures.

Structure H is a small circular feature built of unshaped masonry situated at the base of small ledge north-east and down slope of Structure A. The CRRP discovered this feature during the course of remapping Site 0889. It measures approximately 3.5m in diameter. The walls of Structure H consist of five to six courses of unshaped basalt masonry forming a U shape that ties into the rock ledge. Additional stones lie immediately down slope of the feature. The walls may have been approximately 1.5m tall before they partially collapsed. A single sherd of Flyod/ Deadmans Gray was noted within the feature.

030700101467 (Sky Site) is a previously recorded site. The CRRP reexamined and remapped this site. It consists of single Cohonina rectangular structure built of unshaped masonry. This integrative site is located at about 2,004m in elevation and is in Great Basin Conifer woodland. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the Northeastern flank of Pittsberg. The structure is situated at the apex of Pittsberg's eastern foothill and dated from the Medicine Valley to early Hull phase. This site has been impacted by a large Piñon pine that has grown and since died within the structure. A small modern period fire ring is located approximately 15m to the west of the structure. The masonry structure consists of a mound of architectural rubble approximately 50cm high surrounding in situ building stones. There is enough rubble to suggest the walls may have been approximately 2.0m tall before they collapsed. There is no indication of a doorway. Ceramic types noted at the site include Floyd/Deadmans Gray, Tusayan Corrugated, and Black Mesa Black-on-white. Chipped stone artifacts noted at site include a single Rosegate Variety B style projectile point of Kaibab Chert. CCD dates this site to between the mid 11th and 12th centuries (A.D. 1050 to 1150).

030700101468 is a previously recorded site (Figure A.1). KNF site cards indicate it is a Cohonina, late Medicine Valley to early Hull phase, masonry outline with three associated artifact scatters. This habitation site is located at about 2,077m in elevation and is in Great Basin Conifer woodland. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the Northeastern flank of Pittsberg. The structure measures approximately 6m long by 4m wide. One course of unshaped masonry blocks is present. The original structure may have consisted of a masonry foundation and jacal superstructure. Ceramic types noted at the site include Floyd/Deadmans Gray, Tusayan Corrugated, and Black Mesa Black-on-white. Chipped stone artifact materials include Kaibab Chert, Government Mountain Obsidian, and RS Hill Obsidian. A single Red Lake Nonserrated style projectile point of Government Mountain Obsidian was noted at the site as well. MSTD dates this site to the early 12th century (A.D. 1115 ± 42 years).

030700102433 is a previously recorded site (Figure A.2). KNF site cards indicate it is a Cohonina, Coconino phase, one room collapsed masonry structure, two circular depressions (possibly pit houses), and a sherd and lithic scatter. This habitation site is located at about 2,054m in elevation and is in Great Basin Conifer woodland. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the Northeastern flank of Pittsberg. The masonry structure measures approximately 4m long by 4m wide, while the two depressions measure approximately 5m in diameter and 20cm deep. The masonry structure consists of approximately four courses of unshaped masonry blocks. Architectural debris surrounding the in situ building stones suggest the walls may have stood approximately 1.5m high before they collapsed. There is no indication of a doorway. Ceramic types noted at the site

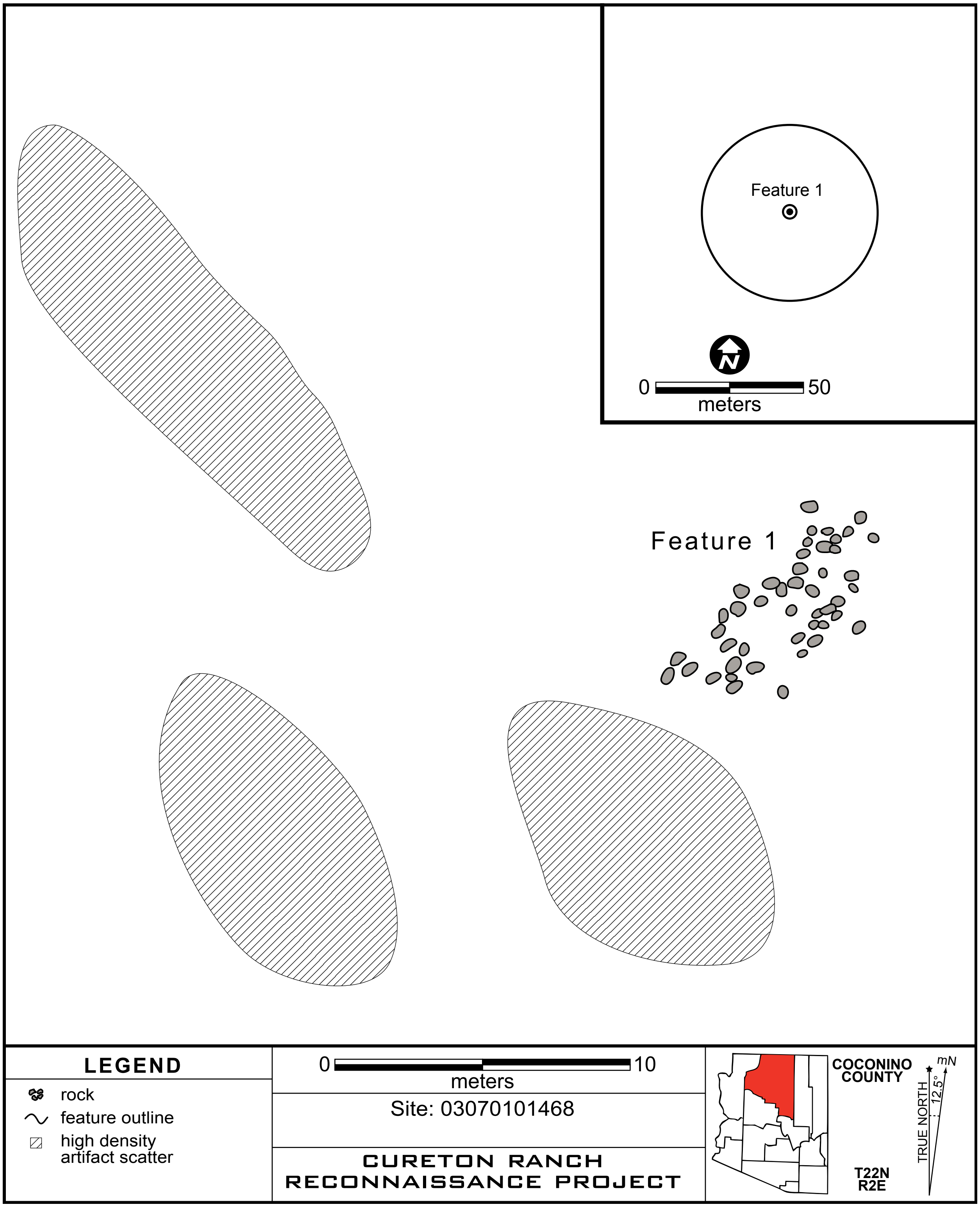


Figure A.1. Site 03070101468 sketch map.

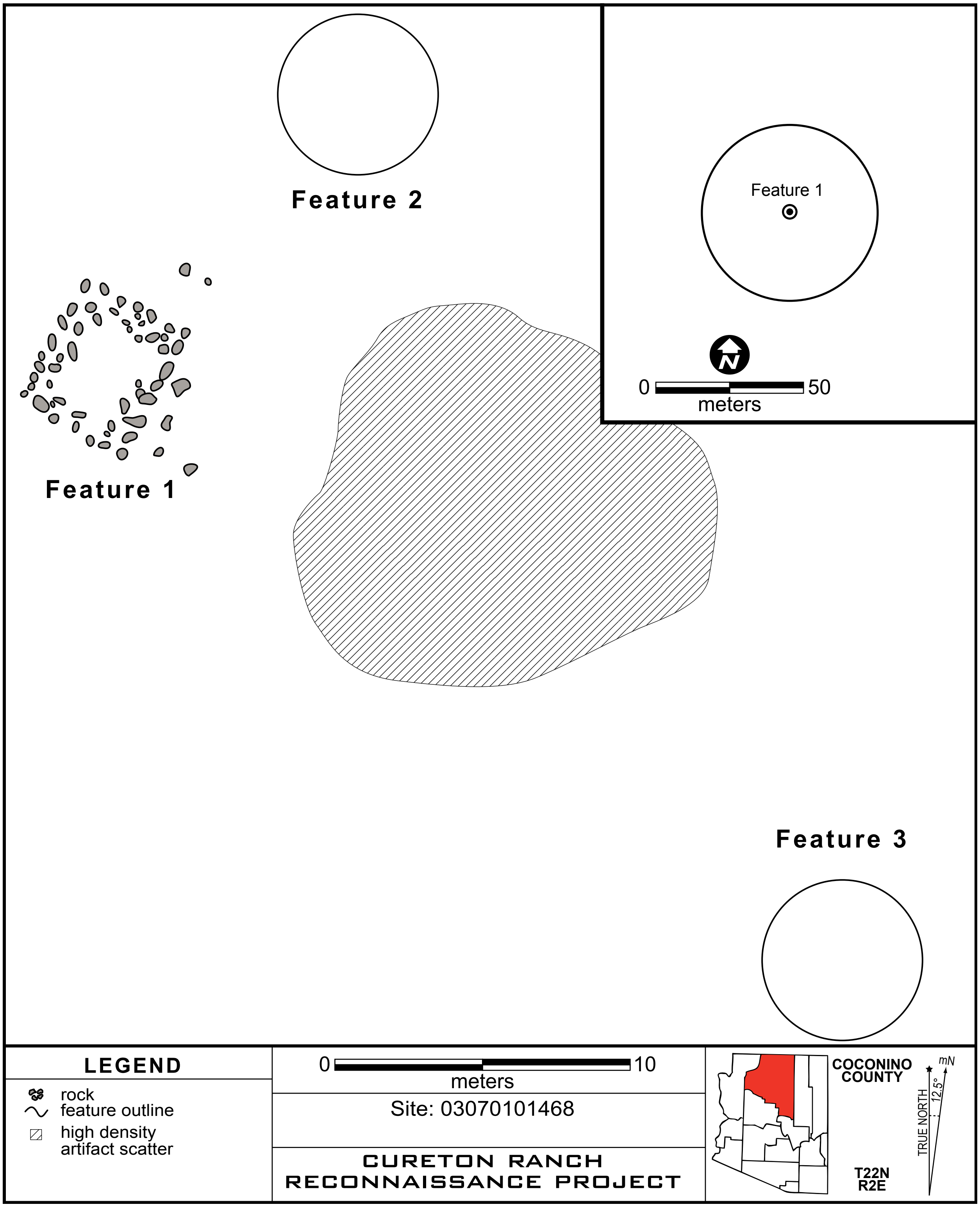


Figure A.2. Site 03070102433 sketch map.

include Floyd/Deadman's Gray, Rio de Flag Brown, possible Tizon Brown Ware, and Moenkopi Corrugated. Chipped stone artifacts noted at the site include core reduction flakes of Kaibab Chert, Government Mountain Obsidian, basalt, Partridge Creek Rhyolite, and one possible Elko style projectile point fragment of Presley Wash Obsidian. MSTD dates this site to the late 10th century (A.D. 976 ± 42 years).

This site matches the description of NA2400, one of four sites the 1938 expedition excavated in the project area. Colton (1946:202) describes NA2400 as consisting of a masonry structure measuring approximately 10ft long and 8ft wide, and several circular rock outlines. The latter features are described as the remains of brush huts. No site map exists for NA400, but MNA archives indicate it is located on the southeast slope of Pittsberg and sporting a metal stake, the latter presumably a datum stake. This description puts the two sites in the same general vicinity, but a metal stake was not found at Site 02433. Thus the CRRP could not positively identify this site as NA2400.

03070102787 (AZ H:12:31[ASM]) is a previously recorded site. AZSite site cards indicate it is a historic camp associated with an old alignment of the Canyon Highway (State Route 64). It consists of a structure foundation, cleared tent pads, middens, fire-pits and a latrine or storage pit. The latter feature consists of shallow pit covered by railroad ties. A date nail from one of the railroad ties indicates a date of 1905. Time constraints prevented the CRRP from producing an updated site map.

03070102774 is a Cohonina, Medicine Valley phase, site located on the Cureton Ranch (Figures A.3 and A.4). The site has been impacted by ranching and casual collection. This habitation site is located at about 2,010m in elevation and is in Great Basin Conifer woodland. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the Northeastern flank of Pittsberg. MSTD dates this site to the early 12th century (A.D. 1114 ± 42 years).

Site 03070102774 is comprised of two loci (Locus A and Locus B) connected by a continuous, but low density artifact scatter. Locus A consists of an artifact scatter and one feature. Surface artifacts at Locus A include ceramics, lithics and groundstone. Approximately 500 ceramic sherds are present including the following wares/types: Floyd/Deadmans Gray, Deadmans Black-on-grey and Undifferentiated Tusayan Gray Ware (corrugated and plain). Lithic material consists of approximately 50 secondary flakes representing the following material types: Kaibab chert, Government Mountain obsidian, RS Hill obsidian, and Partridge Creek volcanics. Groundstone present includes one metate fragment of vesicular basalt and approximately 10 small fragments of Coconino sandstone. There is one feature at Locus A consisting of a small, circular depression measuring 2m in diameter. The depression is surrounded by a scatter of small basalt cobbles and fragments of Coconino sandstone.

Locus B consists of an artifact scatter and one feature. Surface artifacts at Locus B include ceramics, lithics and groundstone. Approximately 2,000 ceramic sherds are present including the following wares/types: Floyd/Deadmans Gray, Deadmans Fugitive Red, Deadmans Black-on-Gray, Undifferentiated Tusayan Gray Ware, and Undifferentiated Tsegi Orange Ware.

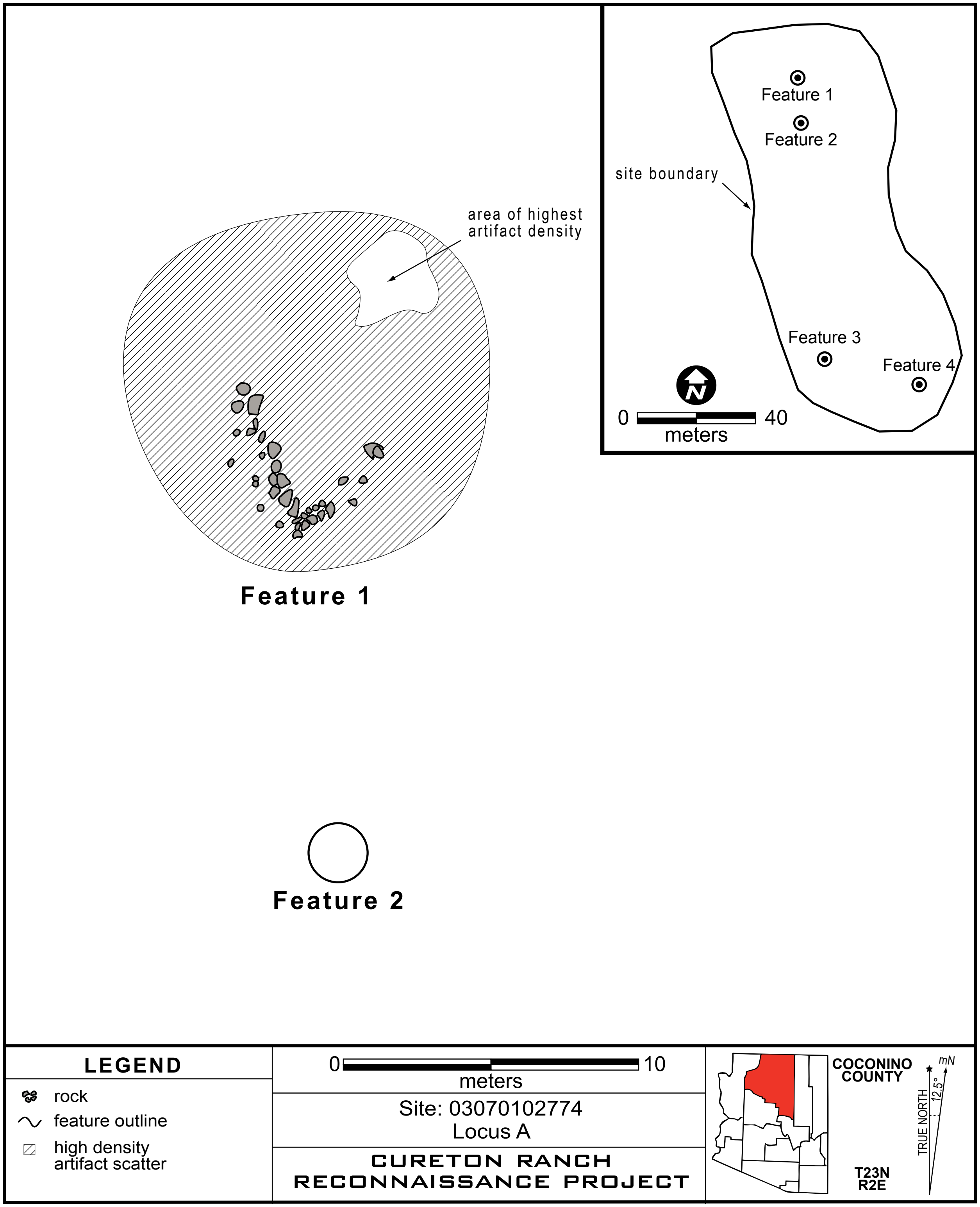


Figure A.3. Site 03070102774 Locus A sketch map.

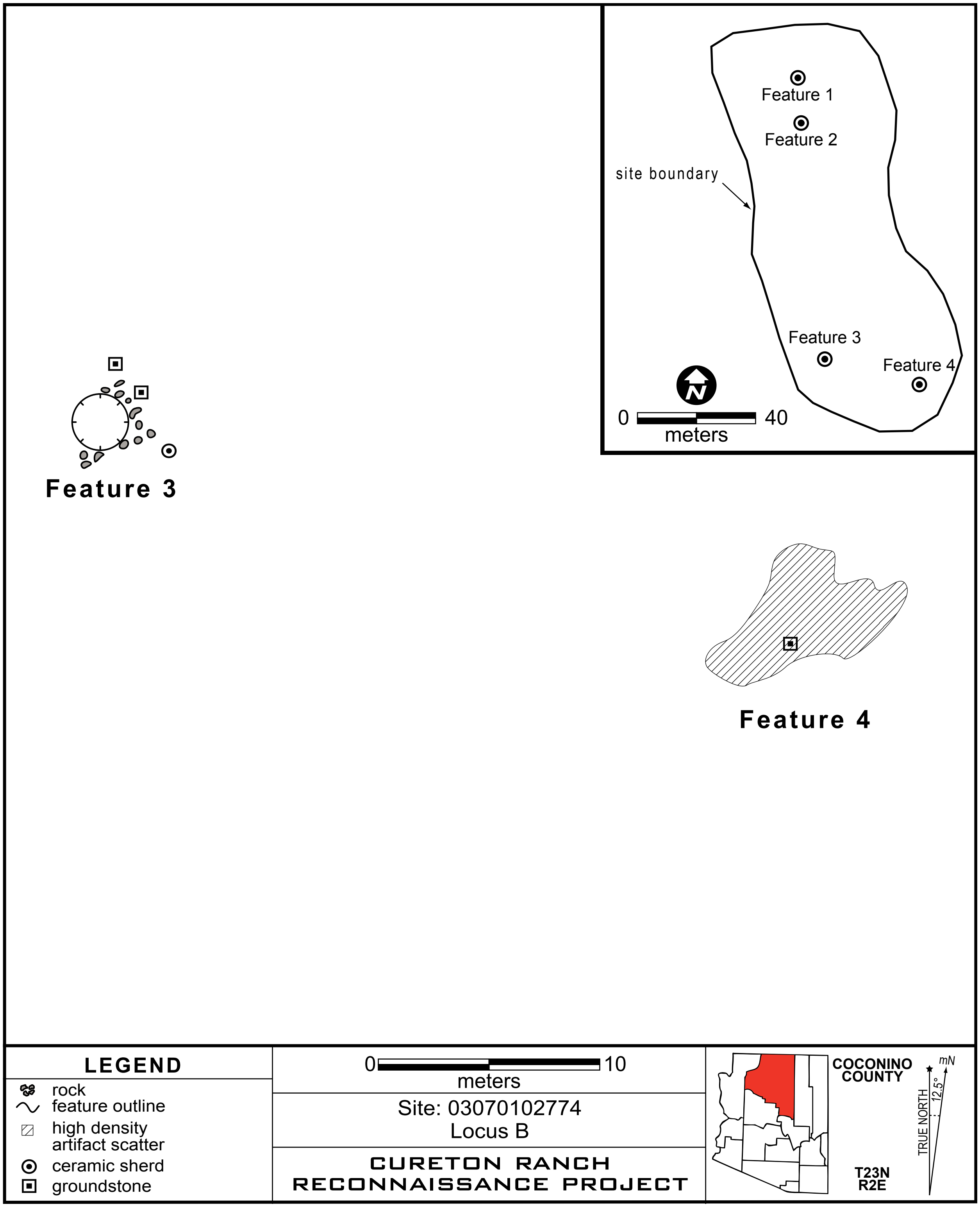


Figure A.4. Site 03070102774 Locus B sketch map.

Lithic material consists of approximately 500 secondary flakes representing the following material types: Kaibab chert, Government Mountain Obsidian, RS Hill Obsidian, and Partridge Creek volcanics. There is one feature at Locus B consisting of a structure defined by two walls forming an L-shaped alignment of basalt cobbles measuring 5m northwest to southeast by 4m southwest to northeast. The collapsed walls of the structure consist of debris piles approximately 1m wide and 20cm tall at their highest points.

03070102775 is a Cohonina, Medicine Valley phase, site located on the Cureton Ranch (Figure A.5). The site has been impacted by ranching and casual collection. This habitation site is located at about 2,010m in elevation and is in Great Basin Conifer woodland. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the Northeastern flank of Pittsberg. MSTD dates this site to the early 12th century (A.D. 1130 ± 42 years).

Site 03070102775 is comprised of two features surrounded by a high density artifact scatter. Surface artifacts include ceramics, lithics and groundstone. Approximately 8,000 ceramic sherds are present including the following wares/types: Deadmans Fugitive Red, Undifferentiated Tusayan Gray Ware, Black Mesa Black-on-white and Medicine Black-on-red. Lithic material consists of primary and secondary flakes numbering at approximately 2,000 pieces representing the following material types: Kaibab chert and Government Mountain obsidian. Two formal stone tools are present at the site consisting of a small projectile point tip and a utilized flake with a serrated edge. Both the projectile point and utilized flake are made of Government Mountain obsidian. Groundstone present includes approximately 20 small fragments of Coconino sandstone. Feature 1 consists of a circular mound of soil 10m in diameter and approximately 1 meter tall. Basalt cobbles are present at the summit of the mound. Bitter Condalia bushes occupy the margins of the mound. Feature 2 is located northwest of the mound and consists of an alignment of basalt cobbles fourm in length, oriented north-northwest.

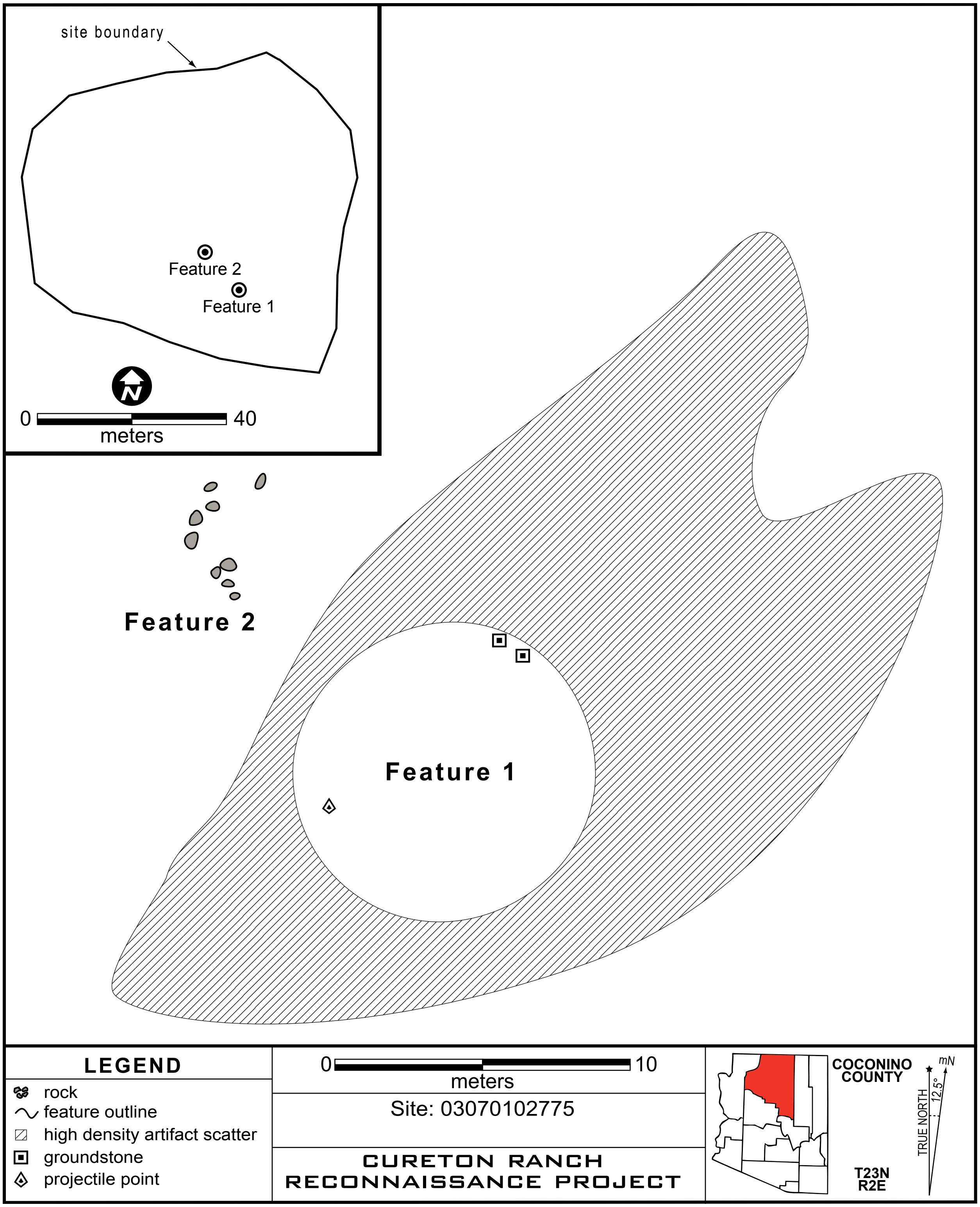


Figure A.5. Site 03070102775 sketch map.

03070102776 (Honani House) is a large Cohonina, Coconino to Medicine Valley phase, site located on the Cureton Ranch (Figures A.6 to A.13). The site has been impacted by ranching and casual collection. This habitation site is located at about 2,040m in elevation and is in Great Basin Conifer woodland. This large habitation site is positioned on a low ridge and consists of numerous individual structures, roomblocks and middens and is the largest component of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the Northeastern flank of Pittsberg. MSTD dates this site to the mid 12th century (A.D. 1145 ± 42 years).

The Honani Site is comprised of at least 13 features surrounded by a broad and high density artifact scatter. Surface artifacts include ceramics, lithics and groundstone. Ceramic sherds number in the tens of thousands and include the following wares/types: Floyd Gray, Floyd Gray Fugitive Red, Deadmans Gray, Deadmans Fugitive Red, Floyd Black-on-grey, Deadmans Black-on-grey, Verde Gray, Deadmans Black-on-red, Clapboard Corrugated, Tusayan Corrugated, Moenkopi Corrugated, Lino Black-on-grey, Kana-A Black-on-white, Black Mesa Black-on-white, Shato Black-on-white, Medicine Black-on-red, and Citadel Polychrome. Lithic material consists of primary, secondary and tertiary flakes numbering in the tens of thousands of pieces, representing the following material types: Kaibab chert, Government Mountain obsidian, Presley Wash obsidian, Sitgreaves obsidian, Partridge Creek volcanics, chalcedony, and Perkinsville jasper. Hundreds of formal stone tools are present including utilized flakes, bifaces and projectile points. Two of these tools deserve special mention. A point made of Presley Wash Obsidian, exhibiting the following features resembles potentially late Paleoindian to Early Archaic points reported by Lyndon (2005:54-56): prominent shoulders, large stem, slightly contracting and convex base, parallel flake scars, and no basal grinding or pressure flake scars. The other projectile is a Desert Side Notch projectile point made of Kaibab chert with a late date range (A.D. 1300 to 1600) that postdates the accepted Cohonina occupation in the region west of the San Francisco Peaks. Groundstone present numbers in the thousands of pieces and includes complete manos (basin, trough), metates (basin and flat/concave, ¾ trough) abrading stones, polishing stones, tool fragments, and production debitage. Groundstone material types include Coconino sandstone, vesicular basalt, and basalt.

13 features are known within the site boundaries. Features 1, 6, 8, 9, 10, 11, and 12 are also basalt cobble and tabular conglomerate constructed rooms or roomblocks, while Features 2, 3, 4, 5, 7 and 13 are depression features. Feature 1 consists of a linear mounded area 20m long by 5m wide, capped by tabular conglomerate and basalt cobbles. A linear alignment of basalt cobbles oriented perpendicular to the mound lies at its southern boundary. Artifact density is high on and around the mound and includes a fan of midden debris extending downslope from the feature for approximately 20m. Formal stone tools are common with Feature 1 and include bifaces, projectile points and utilized flakes. Badgers have excavated burrows into this feature and their backdirt piles contain architectural debris and numerous artifacts. One of these badger holes located on the Southern margin of Feature 1 exposed a large, vertically oriented, basalt metate (¾ trough). Features 6, 9, 10, 11 and 12 are all smaller masonry constructed rooms characterized by a slightly mounded area with alignments or mounds of basalt cobbles or tabular conglomerate. None these features measure more than 3m on a side. Artifact density is high in and around these features. A vesicular basalt mano (¾ trough) was noted amongst the architectural debris of Feature 9. Feature 8 is the largest masonry feature within the site and consists of

a mounded area upon which rests at least two adjoining rooms measuring approximately 20m north to south by 13m east to west and positioned on the crest of a low ridge. On the surface the feature consists of a mounded area approximately 1.5m high with near completely buried alignments of tabular conglomerate and basalt cobbles. Artifact density is high on and around the mounded area. The alignments of stone are recognizable as the outlines of at least two rectangular rooms. A large chipped, pecked and polished metate (basin and flat/concave) of Coconino Sandstone is located southeast of Feature 8.

Features 2, 3, 4, 5, 7 and 13 are depression features recorded within the site boundaries. The majority of these depressions (Features 2, 3, 5, 7, and 13) measure between 3 and 5m in diameter and are not more than 50cm deep. Basalt and/or tabular conglomerate cobbles line the margins of these depressions and artifact density is high in and around these features. Features 4 and 7 deviate from this generalization in that these features have greater diameters and low artifact densities. Feature 4 consists of a large circular depression and surrounding berm 8m in diameter and 40cm deep. Basalt cobbles are present on its margins and artifact density is low around this feature. Feature 7 consists of an irregular depression approximately 5m in diameter with a very low artifact density.

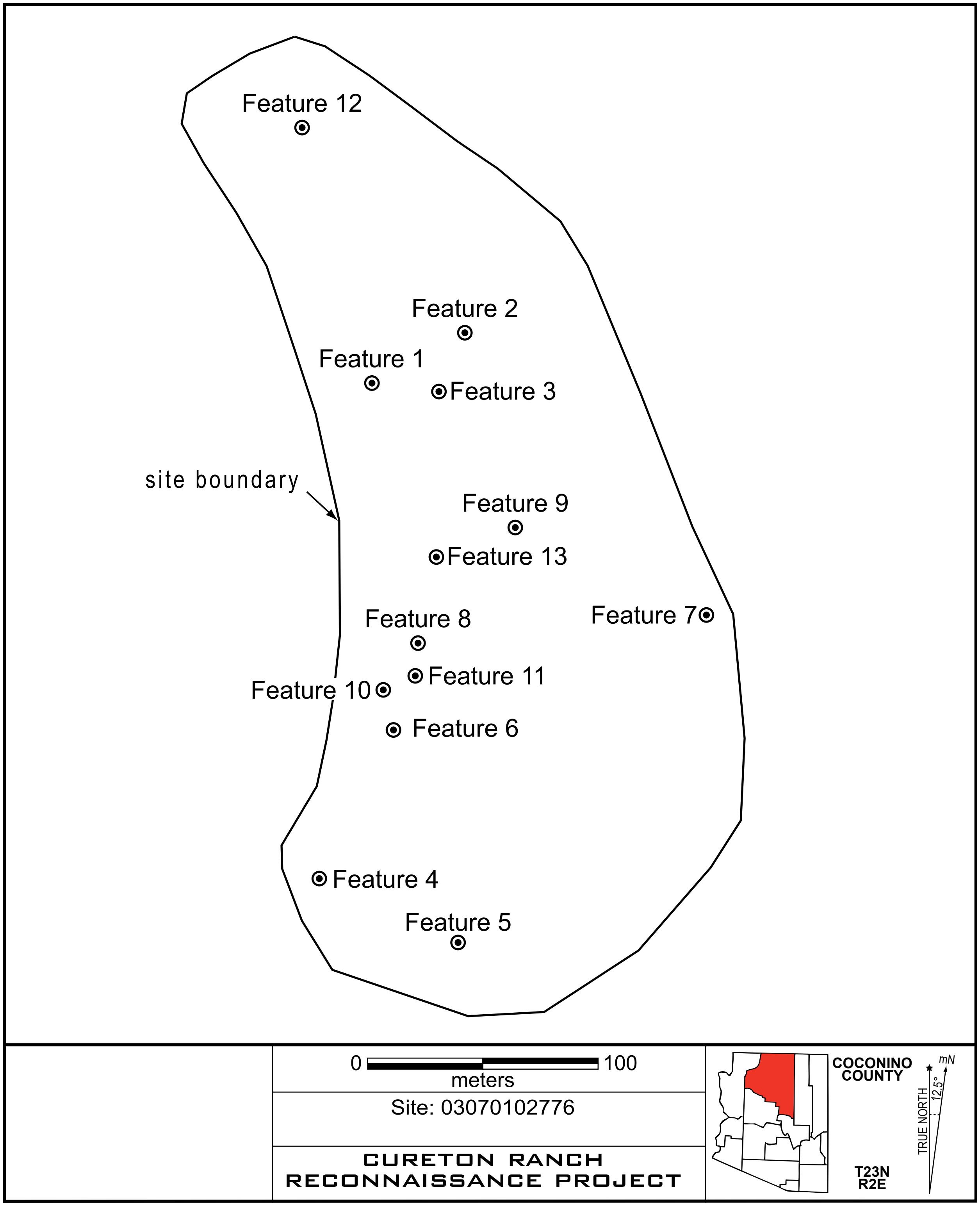


Figure A.6. Site 03070102776 Overall map with feature locations.

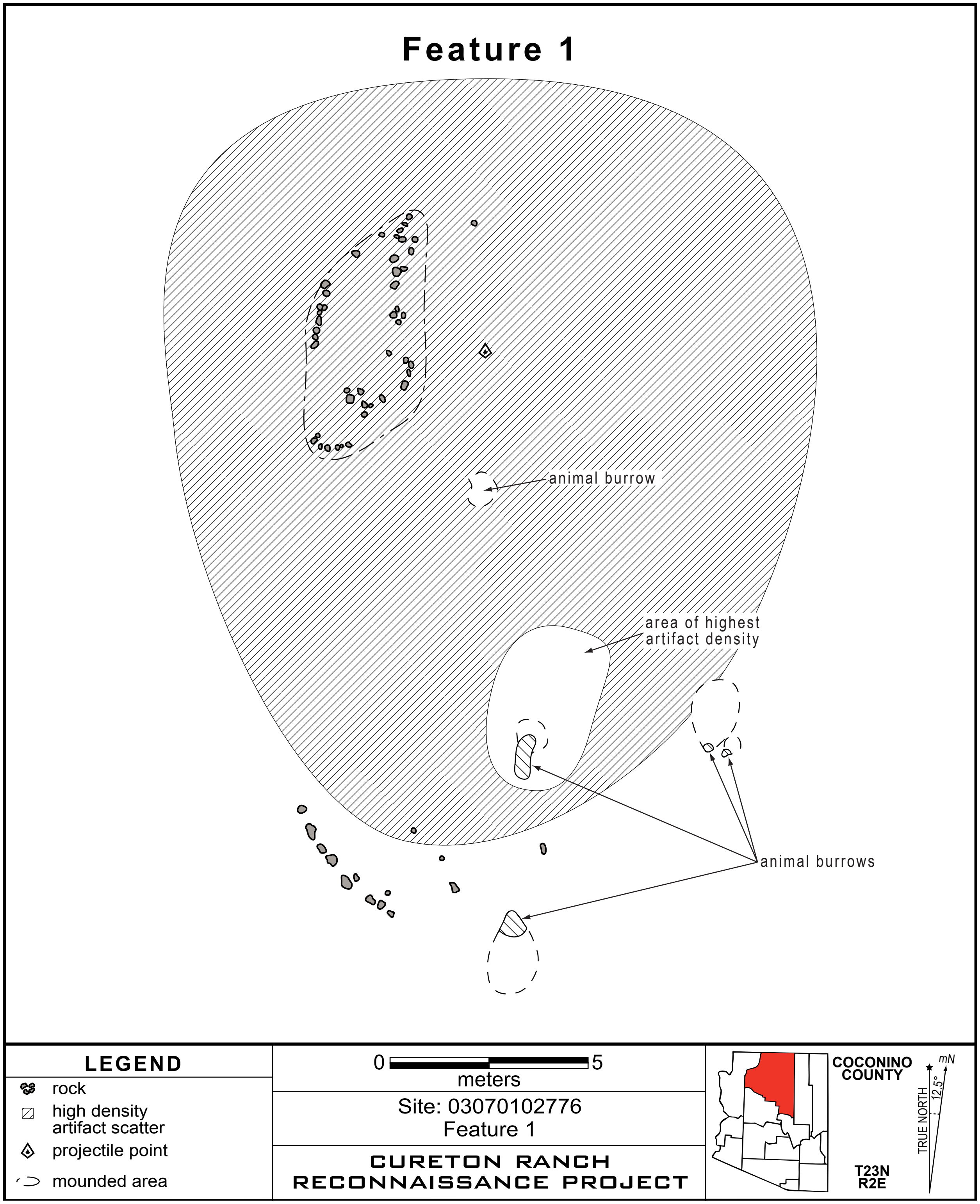


Figure A.7. Site 03070102776, Feature 1.

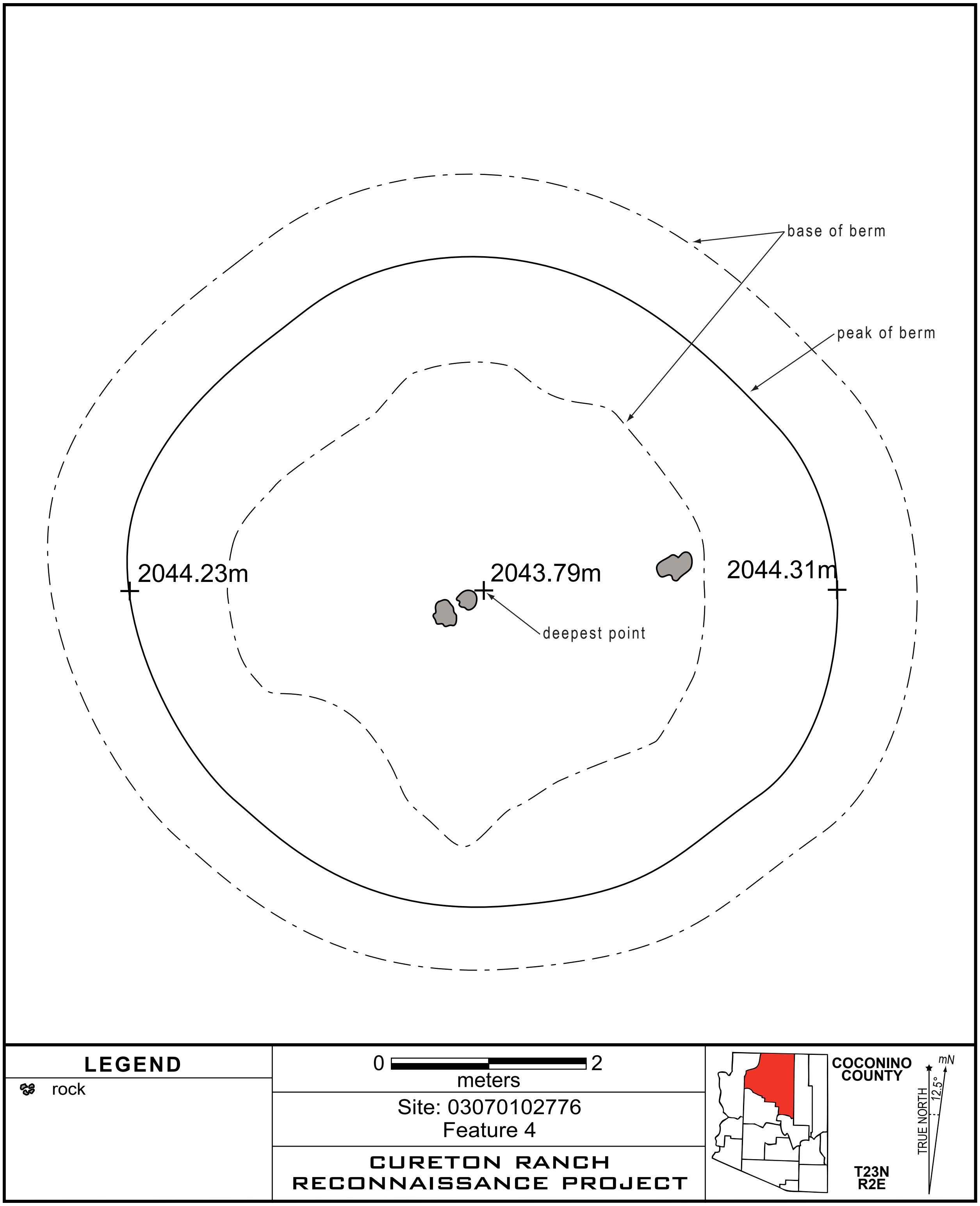


Figure A.8. Site 03070102776, Feature 4.

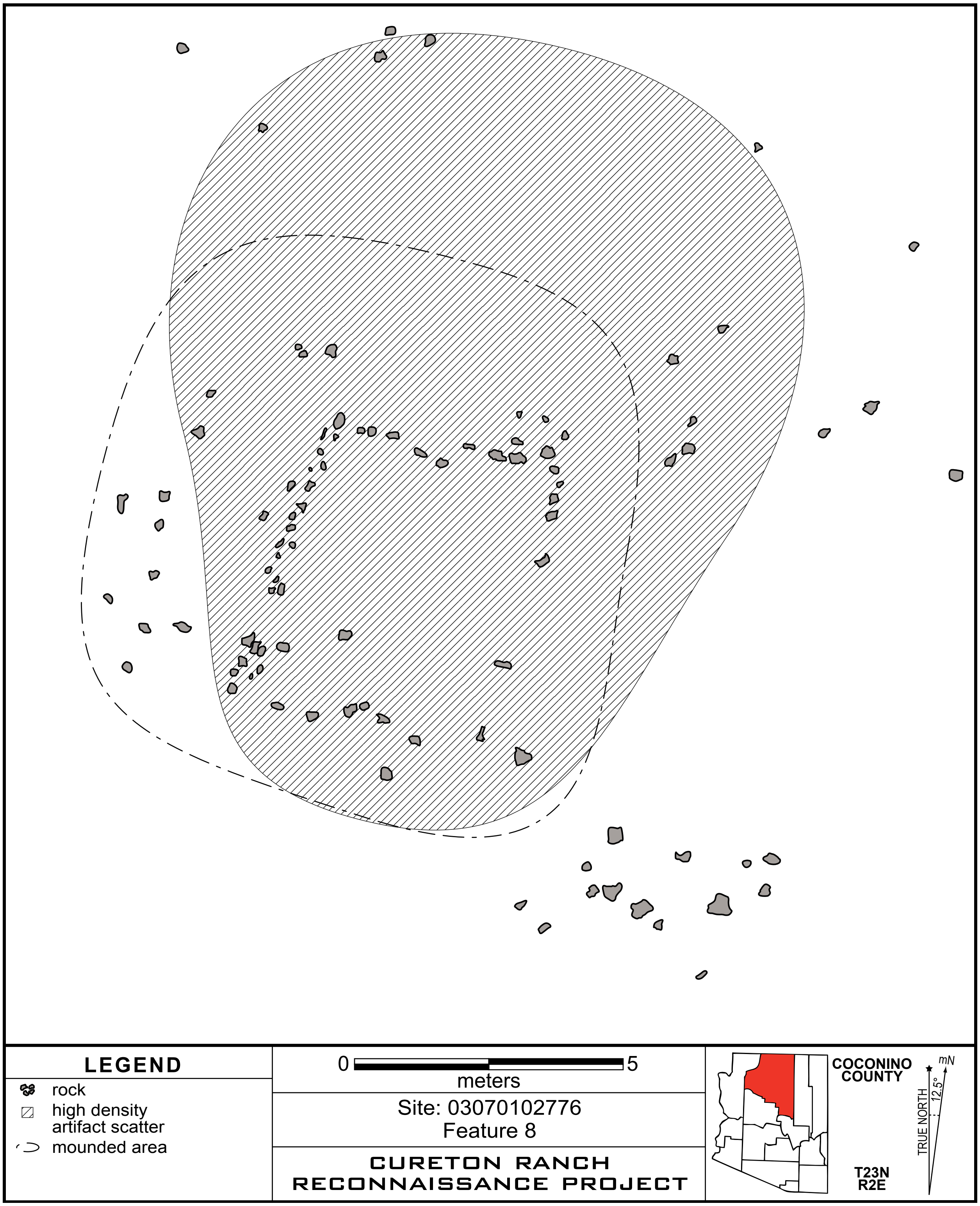


Figure A.9. Site 03070102776, Feature 8.

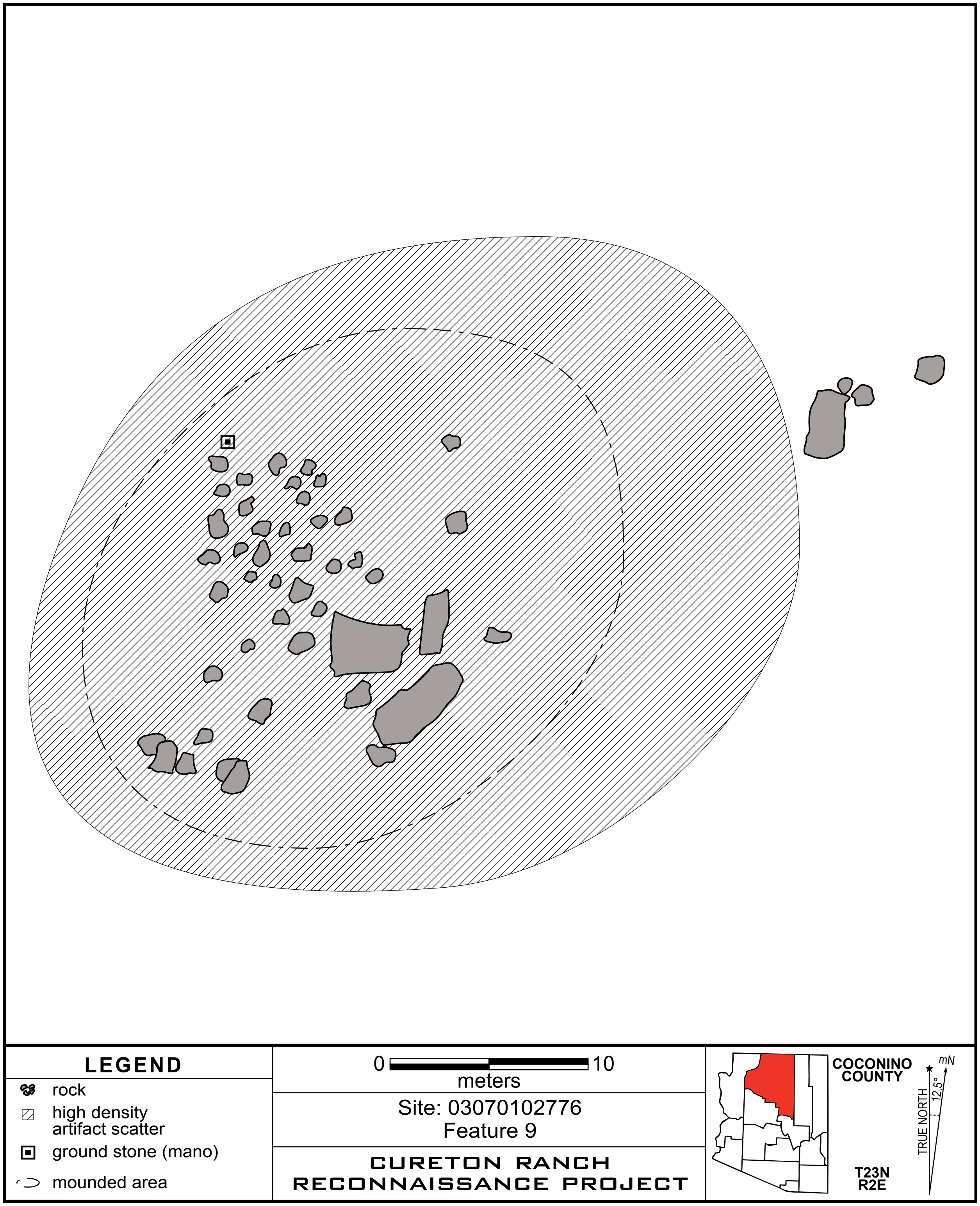


Figure A.10. Site 03070102776, Feature 9.

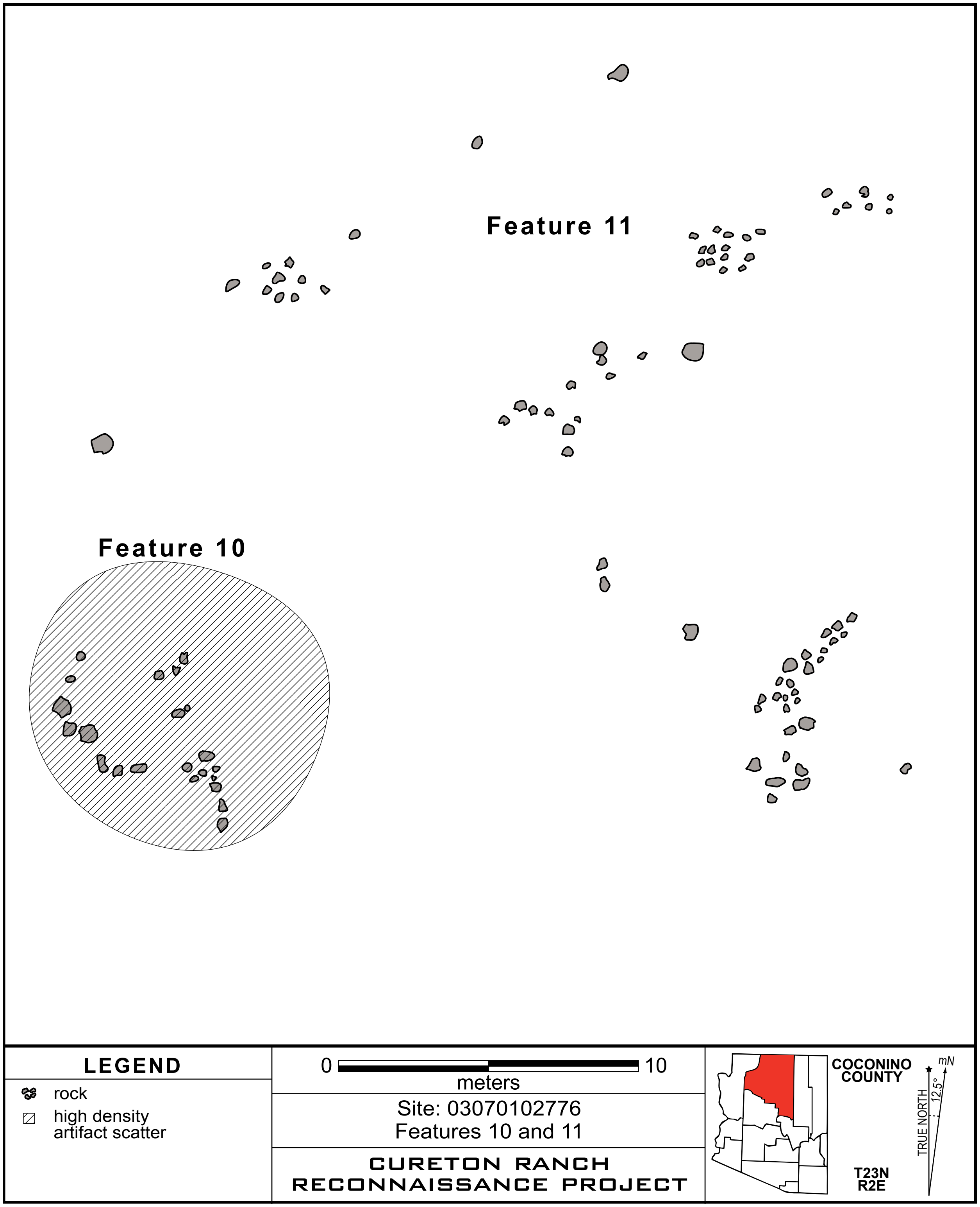


Figure A.11. Site 03070102776, Features 10 and 11.

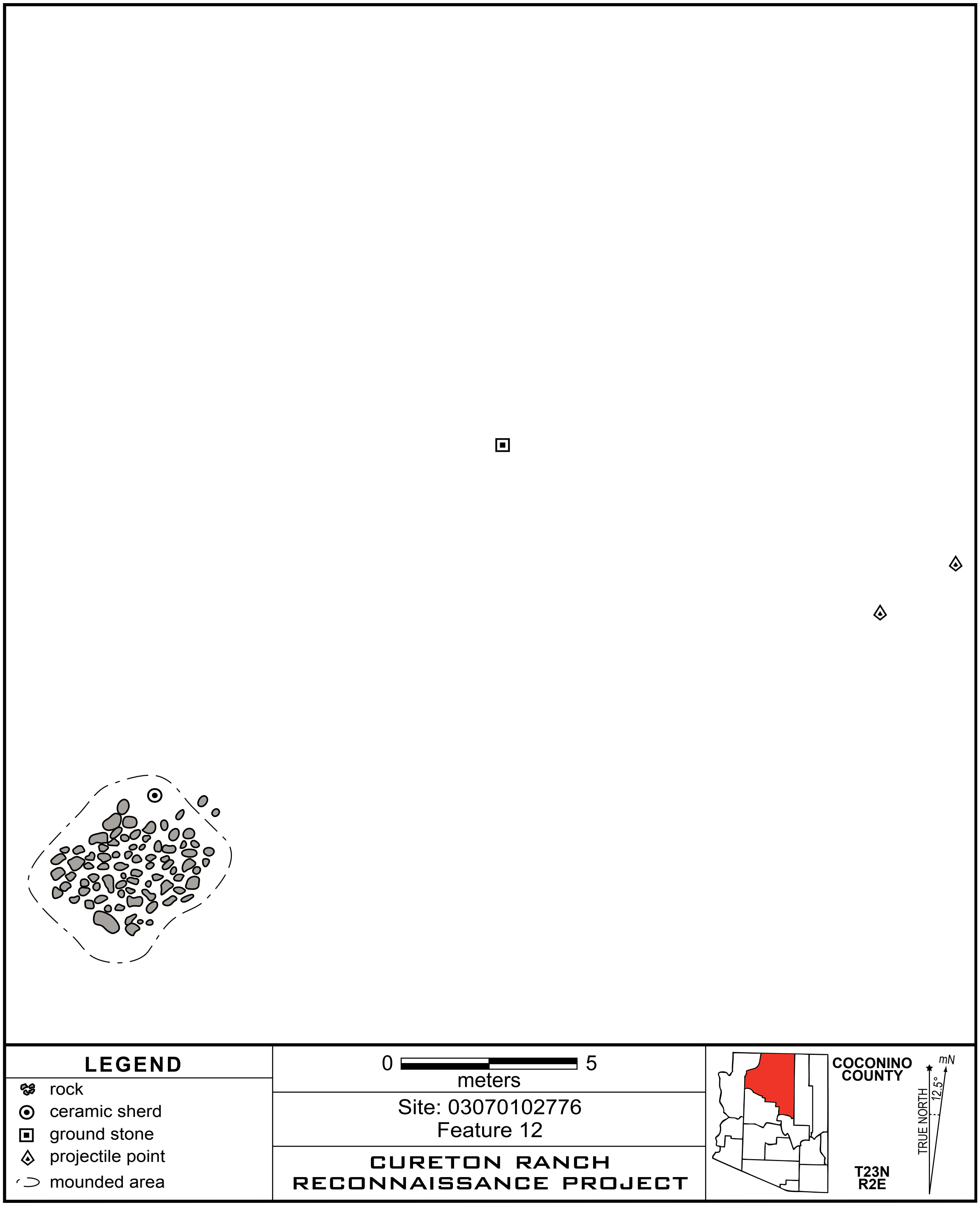


Figure A.12. Site 03070102776, Feature 12.

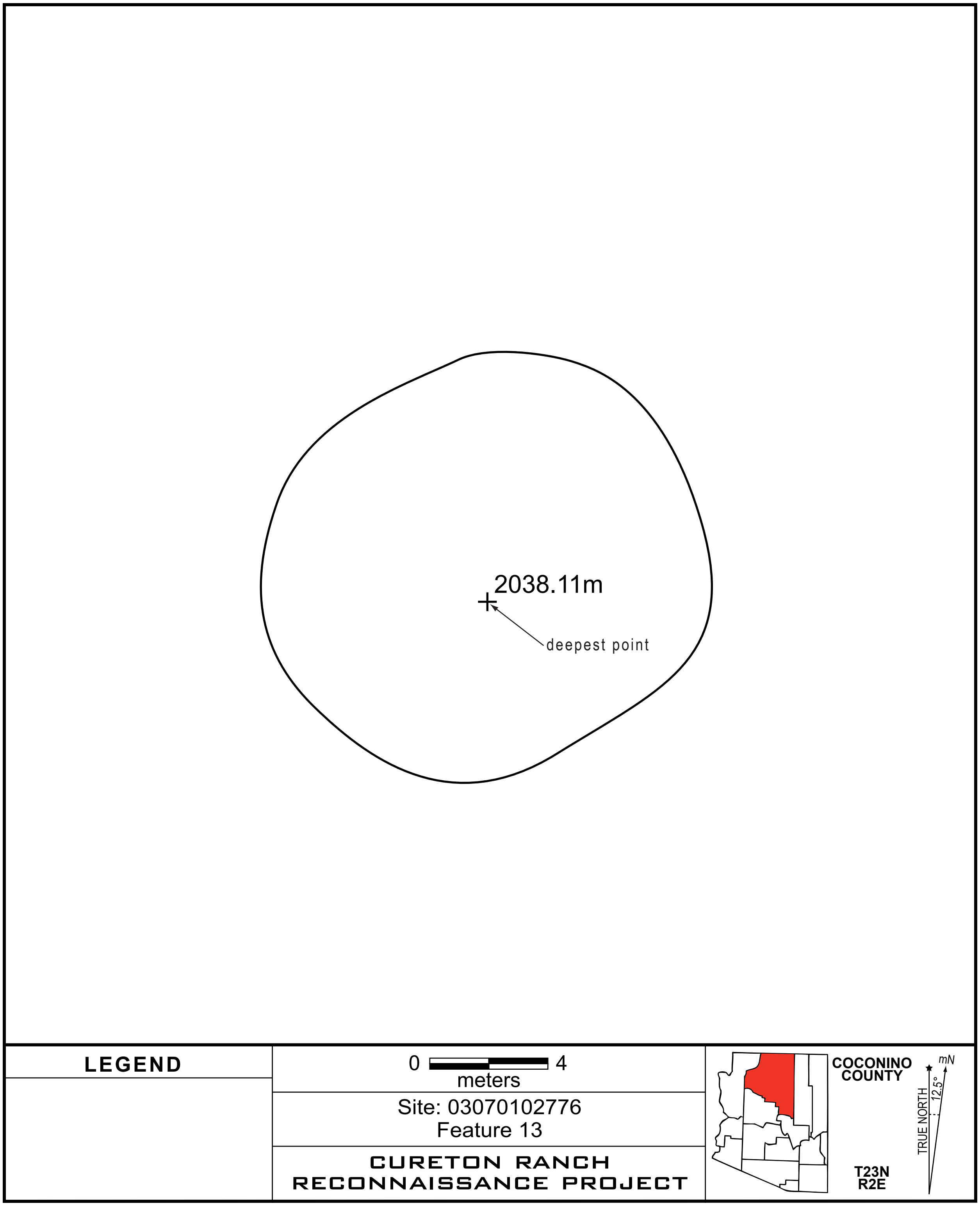


Figure A.13. Site 03070102776, Feature 13.

03070102777 is a Late Historic Euro-American ranching site located on the Cureton Ranch (Figure A.14). The site has been impacted by modern ranching and mining. This site is located at about 1,980m in elevation and located in an isolated stand of ponderosa Pine surrounded by Great Basin Conifer woodland. This site is part of Late Historic ranching connected to lumbering on the Coconino Plateau. Historic documents date this site to the early part of the 20th century (A.D. 1914).

Site 03070102777 is comprised of the New Picket Corral Dam built by a man with the surname Smith in 1914. New Picket Corral Dam is a concrete dam approximately 40m across, 60cm thick at its top-center and 4.5m tall. The dam impounds Cataract Creek at a small canyon along its course. The dam is positioned to take advantage of a narrow point in the canyon where Cataract Creek dissects a basalt flow emanating from Pittsberg.

Erosion and recent construction activity have altered the original morphology of New Picket Corral Dam. The dam was left in a weakened state from repeated flood events since its construction. This flooding removed a substantial volume of earth and bedrock from around the ends of the dam prompting the land owners to reinforce the dam with earthen buttresses in the late 1980s. These improvements held until a flood in 1994 undermined these reinforcements and nearly destroyed the dam. From 2005-2010 the landowners constructed reinforced concrete buttresses to re-anchor the ends of the dam and channel stream flow over the dam. Additional improvements include the installation of a concrete cap on the dam and the construction of a reinforced concrete flip-lip at the downstream base of the dam.

03070102778 is a Cohonina, Hull phase, site located on Kaibab National Forest lands (Figure A.15). The site has been impacted by ranching and casual collection. This habitation site is located at about 2,070m in elevation and is in Great Basin Conifer woodland. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the Northeastern flank of Pittsberg. MSTD dates this site to the early 12th century (A.D. 1100 ± 42 years).

Site 03070102778 is comprised of a rectangular masonry structure and associated artifact scatter. A seep is located 26m to the Southwest of the structure and on the northwest side of a small cliff. Surface artifacts include ceramics and lithics. Approximately 100 ceramic sherds are present at the site including the following wares/types: Floyd/Deadmans Fugitive Red, Deadmans Black-on-grey, and Undifferentiated Tusayan White Ware. Lithic material consists of secondary flakes numbering at approximately 75 pieces. Kaibab chert is the only material present. Groundstone is not present at the site, however hundreds of fragments of Coconino sandstone are present around the site. These fragments are small (less than 15cm on a side), rounded or subrounded and very degraded from chemical and physical erosion. This sandstone along with similarly sized fragments of Kaibab limestone and unknown volcanics are traceable to exposed outcrops of bedded conglomerate that make up the eastern foothill of Pittsberg where the site is positioned. Feature 1 consists of a rectangular alignment of tabular conglomerate and

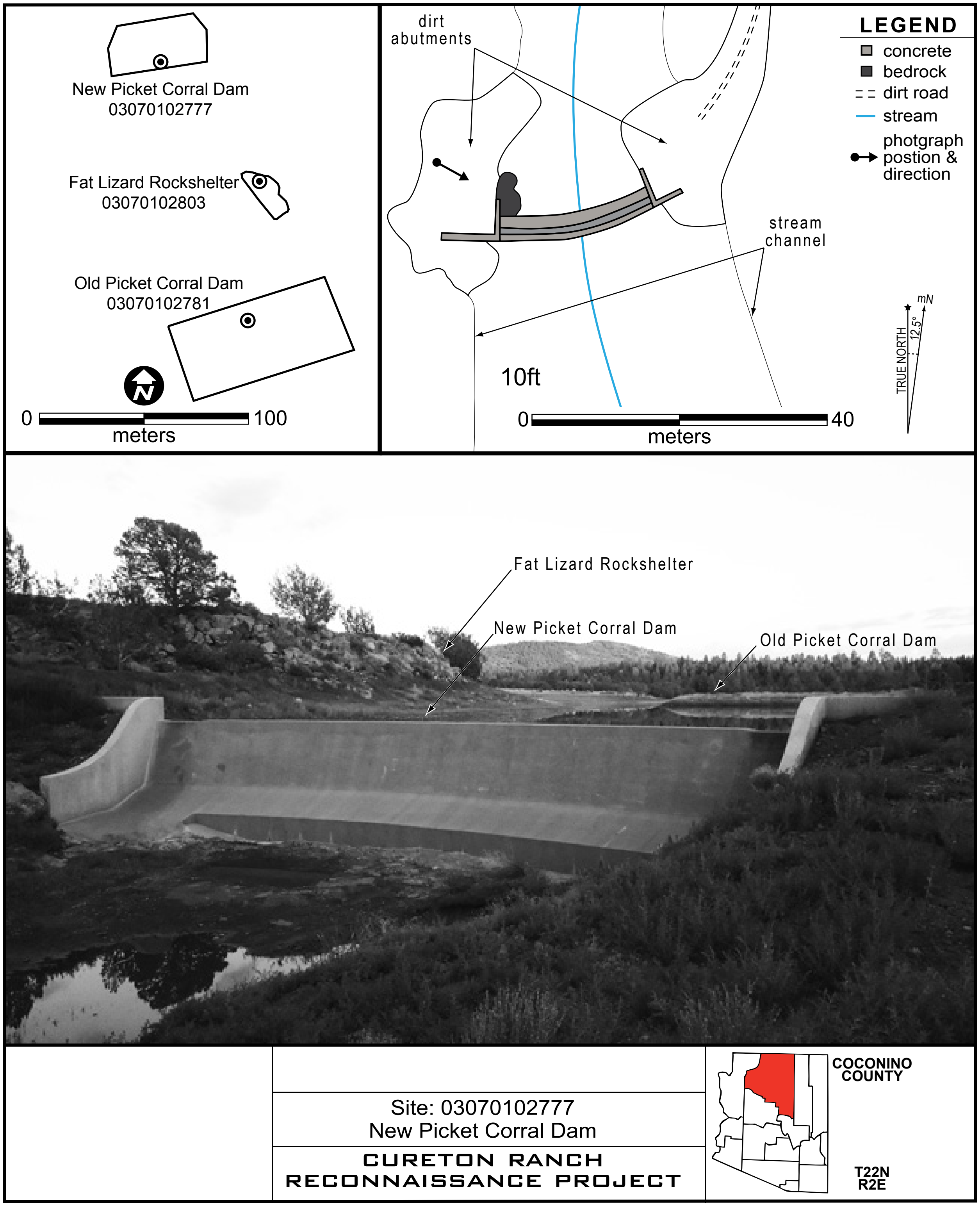


Figure A.14. Site 03070102777.

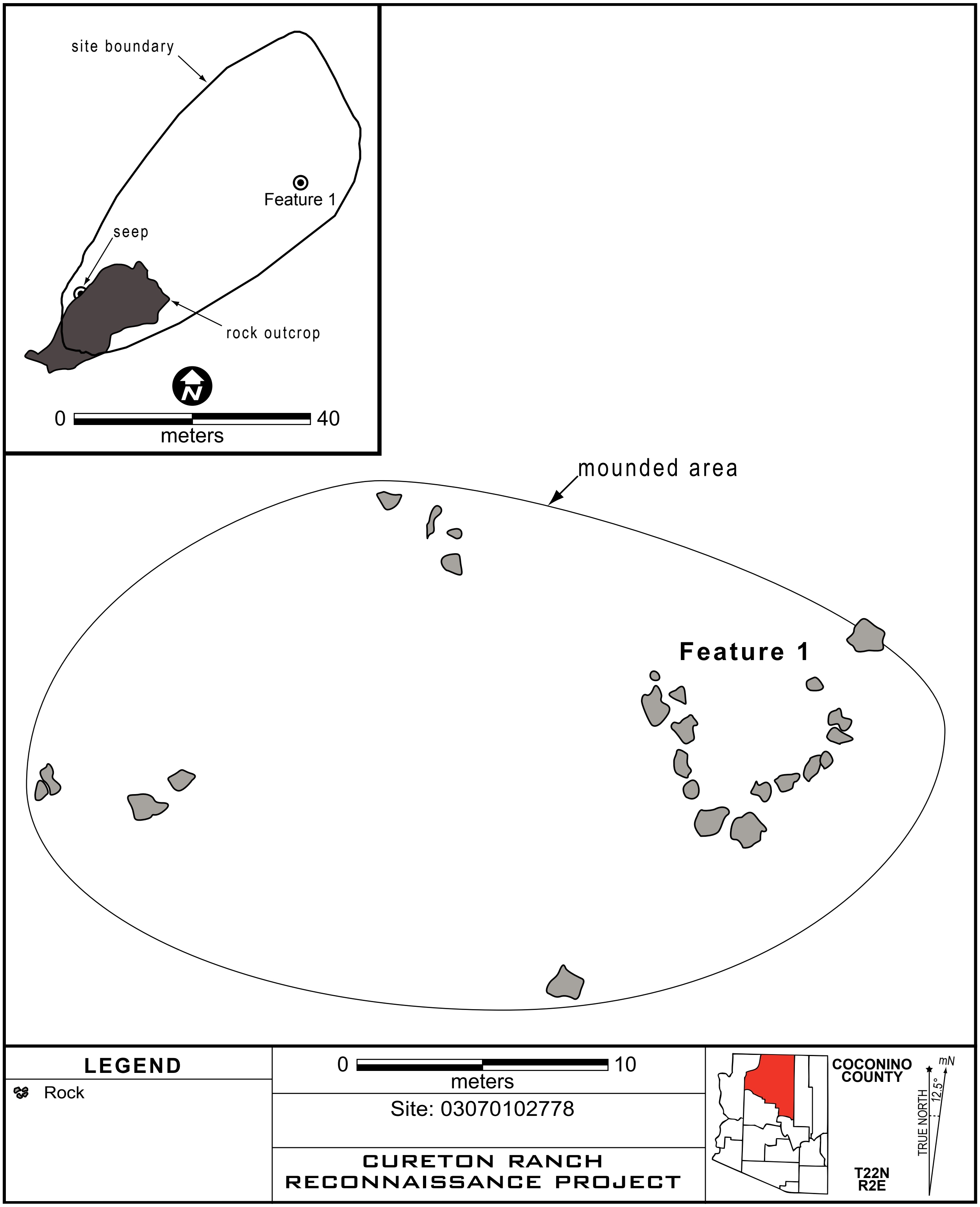


Figure A.15. Site 03070102778 sketch map.

basalt cobbles measuring approximately 8m on a side. This structure is positioned on the northeastern edge of a slightly mounded area approximately 15m in diameter.

03070102779 is a Cohonina Coconino-Medicine Valley habitation site located on Kaibab National Forest lands (Figure A.16). The site has been impacted by ranching and casual collection. This habitation site is located at about 2,070m in elevation and is in Great Basin Conifer woodland. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the northeastern flank of Pittsberg. MSTD dates this site to the late 11th century (A.D. 1078 ± 42 years).

Site 03070102779 is comprised of a five room masonry structure, two small mounds and an associated artifact scatter. The site is situated on the summit of a northwest to southeast trending ridge line. Approximately 1,000 ceramic sherds are present at the site representing the following wares/types: Floyd/Deadmans Gray, Floyd/Deadmans Fugitive Red, Deadmans Black-on-grey, and Black Mesa Black-on-white. Lithic material consists of approximately 300 pieces including cores, secondary flakes and shatter; and representing the following material types: Kaibab chert, Government Mountain obsidian, and an unknown fine grained grey-black volcanic. Groundstone present numbers in the thousands of pieces and includes, tool fragments and production debitage. Coconino sandstone is the only groundstone material type present. Intermixed with this groundstone are small pieces of Coconino sandstone originating from conglomerate bedrock like those described in Site 03070102778's description above.

The presence of this material complicates the identification of ground Coconino sandstone that was transported into the study area, but it does not preclude it. Ground Coconino sandstone is differentiated from conglomerate Coconino sandstone in the survey area through a comparison of gross physical characteristics. Conglomerate Coconino sandstone is always rounded or subrounded, very weathered and often presents a friable rind of discolored material, whereas ground Coconino sandstone is relatively un-weathered, tabular, angular (except finished handstones) and exhibits one or more of the following cultural modifications: pecking, polishing or percussion flaking. In fake a very large piece of Coconino sandstone exhibiting percussion flake scars lies to southeast and down ridge line from Feature 1. It measures approximately 60cm in diameter and 25cm thick and weighing in the neighborhood of 22kg. The nearest source for Coconino sandstone of tool quality lies 32km to the west-southwest near Ashfork, Arizona.

The masonry structures and mounds are positioned on the edge of a small cliff that faces southwest and measures approximately two meters in height. Feature 1 consists of a linear arrangement of five masonry rooms constructed of tabular conglomerate and basalt cobbles. Large blocks of tabular conglomerate form the foundation course on the northwest and southeast ends of the structure and in some portions of the structure two courses of stone are in situ. The structure is approximately 22m long and 8m wide. Architectural debris is distributed on a steep slope below the structure and cliff to the southwest. Portions of collapsed wall are visible on the ridge top with artifacts distributed down the northeast slope of the ridge. Artifact density is highest immediately below Feature 1 at the base of the small cliff. The morphology of Feature 1 falls cleanly into Cartledge's (1986, after McGregor 1967a) "unit structure" functional architectural class. Feature 2 consists of a single mounded semi-circular room 3m in diameter. A single course of tabular conglomerate and basalt cobbles forms its perimeter. Feature 3 consists of a small

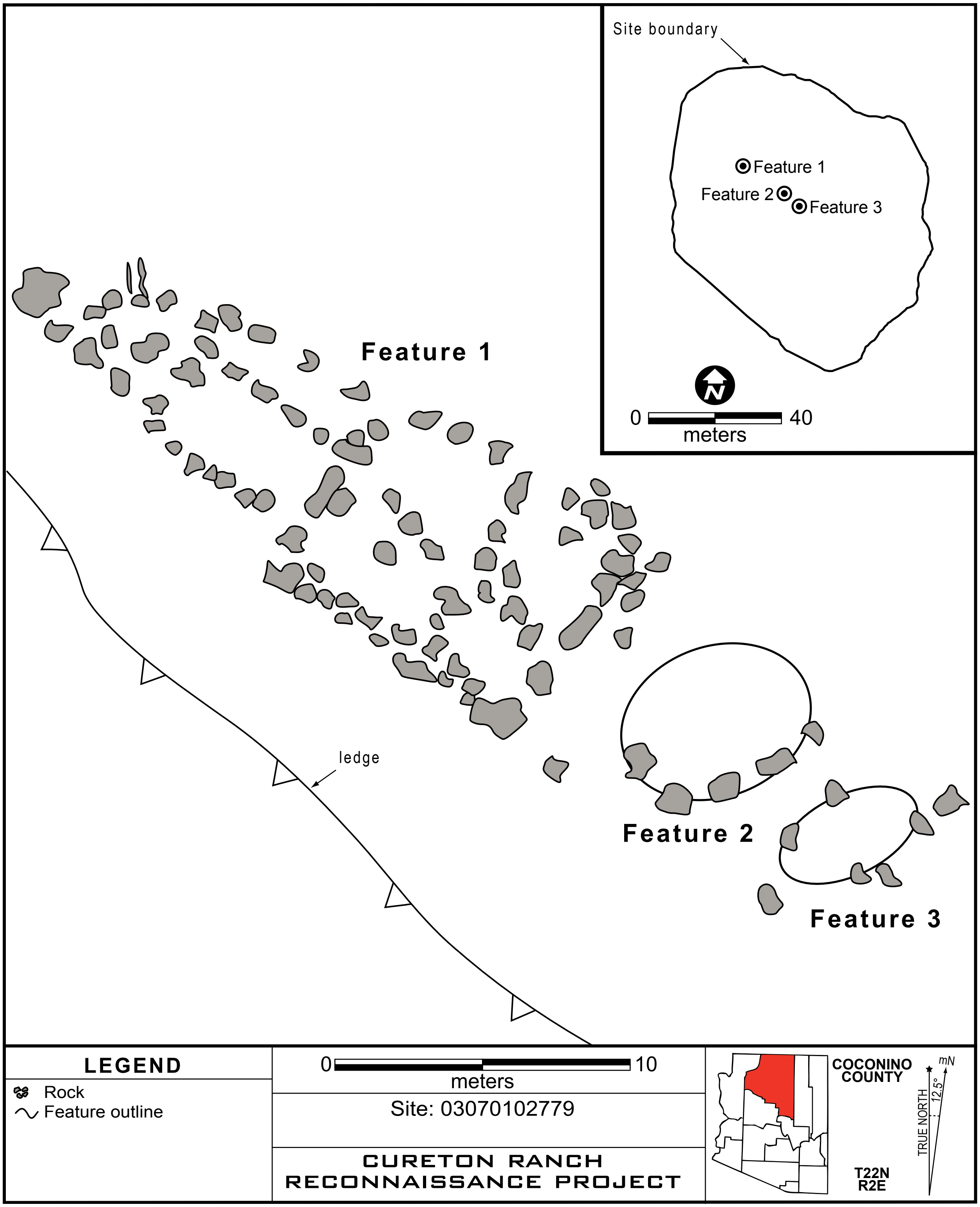


Figure A.16. Site 03070102779 sketch map.

semi-circular mound 2m in diameter. Tabular conglomerate cobbles are present on the southern margin of the feature.

03070102780 (NA2460) is a previously recorded site. It is a Cohonina, Medicine Valley phase, site located on Kaibab National Forest lands (Figure17). The site has been impacted by ranching, excavation, and casual collection. This habitation site is located at about 2,050m in elevation and is in Great Basin Conifer woodland. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the northeastern flank of Pittsberg. MSTD dates this site to the early 12th century (A.D. 1105 ± 42 years).

Site 03070102780 is comprised of a large linear mound of masonry architectural debris adjacent to two shallow ovoid depressions, and an associated low density artifact scatter. A small late Historic period artifact scatter is located immediately south of the architectural debris. The site is located at southeastern base of Pittsberg on a low rise. Approximately 500 ceramic sherds are present at the site representing the following wares/types: Floyd/Deadmans Gray and Undifferentiated Tusayan White Ware. Lithic material consists two utilized flakes, one of Kaibab chert and one of Government Mountain obsidian. These are located within the structure. A fragment of a basalt metate (basin and flat/concave) is located along the southwestern edge of the structure and was the only groundstone located during survey.

The masonry debris and depressions fill an area measuring approximately 35m northwest to southeast by 20m southwest to northeast. Basalt cobbles are the only construction material present and vary in size from 20cm to over 60cm across. A substantial amount of architectural debris is mounded at the northwest and southwest ends of the structure, while the remainder of the feature perimeter is demarcated by a single course of stone. Two large and slightly depressed areas are visible within the structure. The first of these is located at the northwest end of the structure adjacent to the previously mentioned mound of debris and measures approximately 10m in diameter and 30cm deep. The second depressed area is located at the southeast end of the structure adjacent to architectural debris and measures 13m in diameter and 30cm deep. There are also several rock alignments within the feature's perimeter.

This site matches the description of NA2460, one of four sites the 1938 expedition excavated in the project area. Colton (1946:202) describes NA2460 as consisting of a two room masonry structure that probably had head high walls. Its excavators did not encounter evidence of doorways, fire pits, or any evidence of roofing. MNA site cards also mention several pit houses in the immediate area. MNA archives list a single Medicine Gray pitcher (A.D. 1025 to 1075), manos, lithic core material, flakes, projectile points, an axe, bone (presumably un-worked faunal remains), and a unknown quantity of seed (species unknown) as items recovered from this structure. Colton (1946:219) provides a list of ceramics recovered from the general provenience of the structure. Horn-Wilson (1997:133) typed one the projectile points as "Red Lake Serrated" (A.D. 1000 to 1075). No site map exists for NA460, but MNA archives indicate it is located on the southeast slope of Pittsberg on a low rise. This description puts the two sites in the same general vicinity. Photographs taken of Site 2460 during the 1938 MNA expedition confirm Site 2780 is a match in terms of the arrangement of features and views of prominent topographic features. Finally MNA archives indicate that the 1938 expedition's base camp was located on

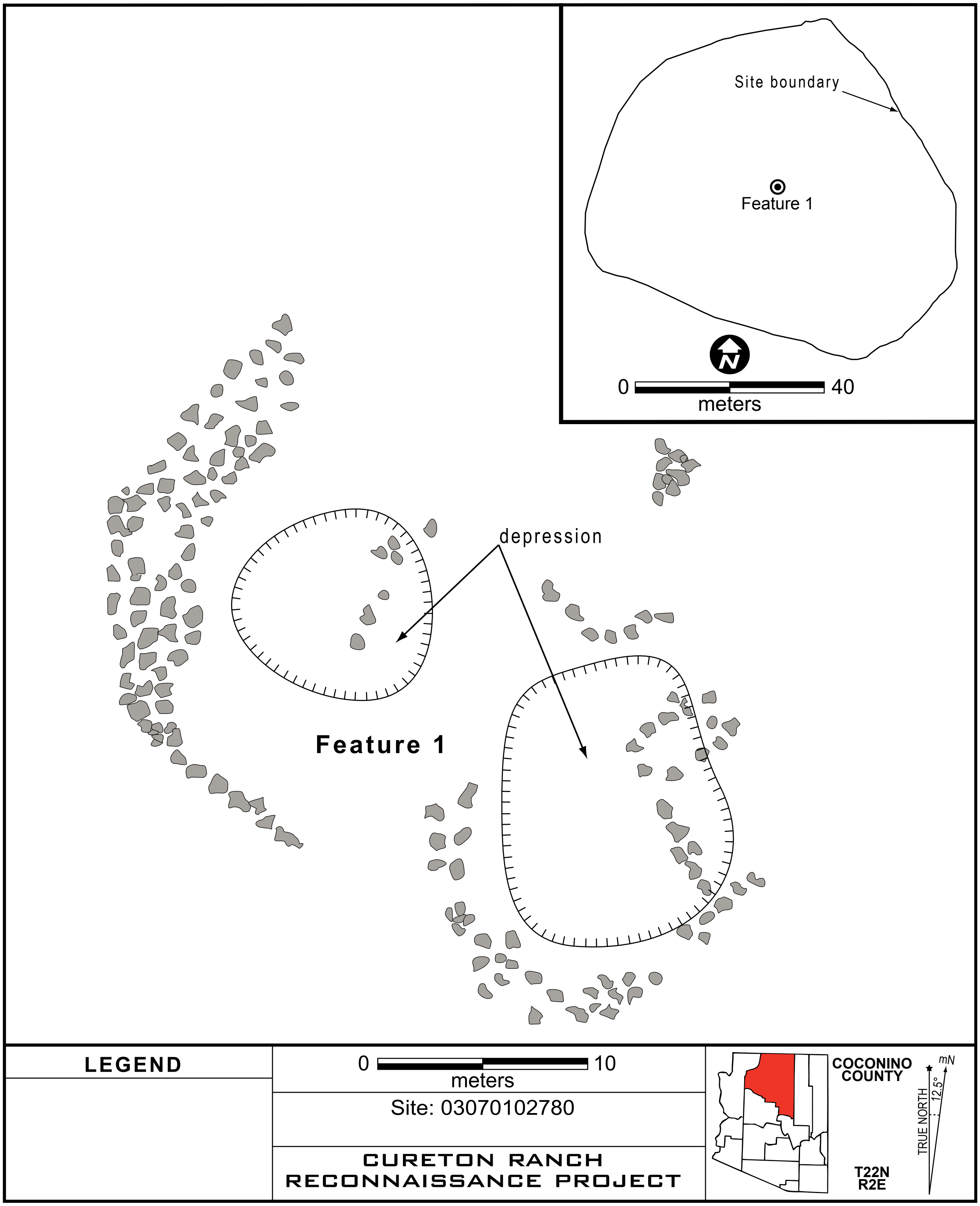


Figure A.17. Site 03070102780 sketch map.

the north side of Pronghorn ranch road in the general vicinity. The late historic artifact scatter adjacent to Site 2460 dates to that period and may be the remains of the expedition's base camp.

03070102781 is a Late Historic Euro-American ranching site located on the Cureton Ranch (Figure A.18). The site has been impacted by modern ranching. This ranching site is located at about 1980m in elevation and is in Great Basin Conifer woodland. This site is part of Late Historic ranching connected to lumbering on the Coconino Plateau. Historic documents date this site to the last part of the 19th century (A.D. 1898).

Site 03070102781 is comprised of the Old Picket Corral Dam built by Charles E. Sweetwood in 1898. Old Picket Corral Dam is an earthen dam approximately 50m across, 10m thick at its base and 3m tall. The dam impounds Cataract Creek downstream from the confluence of Dogtown Wash and Cataract Creek. The dam is positioned just upstream of the mouth of a small canyon where Cataract Creek dissects a basalt flow emanating from Pittsberg.

Recent construction activity has destroyed the original morphology of Old Picket Corral Dam. The land owners have removed approximately half of the original volume of the dam in an effort to rehabilitate the canyon mouth and create a shallow wetland behind the dam.

03070102782 is a Cohonina, Coconino phase, site located on the Cureton Ranch. The site has been impacted by ranching and casual collection. This logistical site is located at about 2,040m in elevation and is in Great Basin Conifer woodland. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the Northeastern flank of Pittsberg. MSTD dates this site to the late 10th century (A.D. 991 ± 42 years).

Site 03070102782 is comprised of a low density artifact scatter containing ceramics, chipped stone and groundstone. The site is located at the base of Pittsberg on its northeastern flank. Approximately 150 ceramic sherds are present including the following wares/types: Floyd/Deadmans Gray, Floyd/Deadmans Fugitive Red, and Lino Black-on-grey. Lithic material consists of approximately 200 secondary flakes representing the following material types: Kaibab chert, Government Mountain obsidian, and Partridge Creek volcanics. Groundstone present includes fragments of Coconino sandstone. Conglomerate derived sandstone is also present at this site. Site 2782 is the only site within the Pittsberg settlement system that exhibits only Lino Black-on-Gray and San Francisco Mountain Gray Ware. This association opens up the possibility that Site 2782 is a very early Hermit phase site despite the Coconino phase MSTD date. However, only controlled excavation could resolve this discrepancy between the CCD dating MSTD dating.

03070102783 is a Cohonina, Medicine Valley phase, site located on the Cureton Ranch. The site has been impacted by ranching and casual collection. This logistical site is located at about 2,040m in elevation and is in Great Basin Conifer woodland. This site is part of the Pittsberg

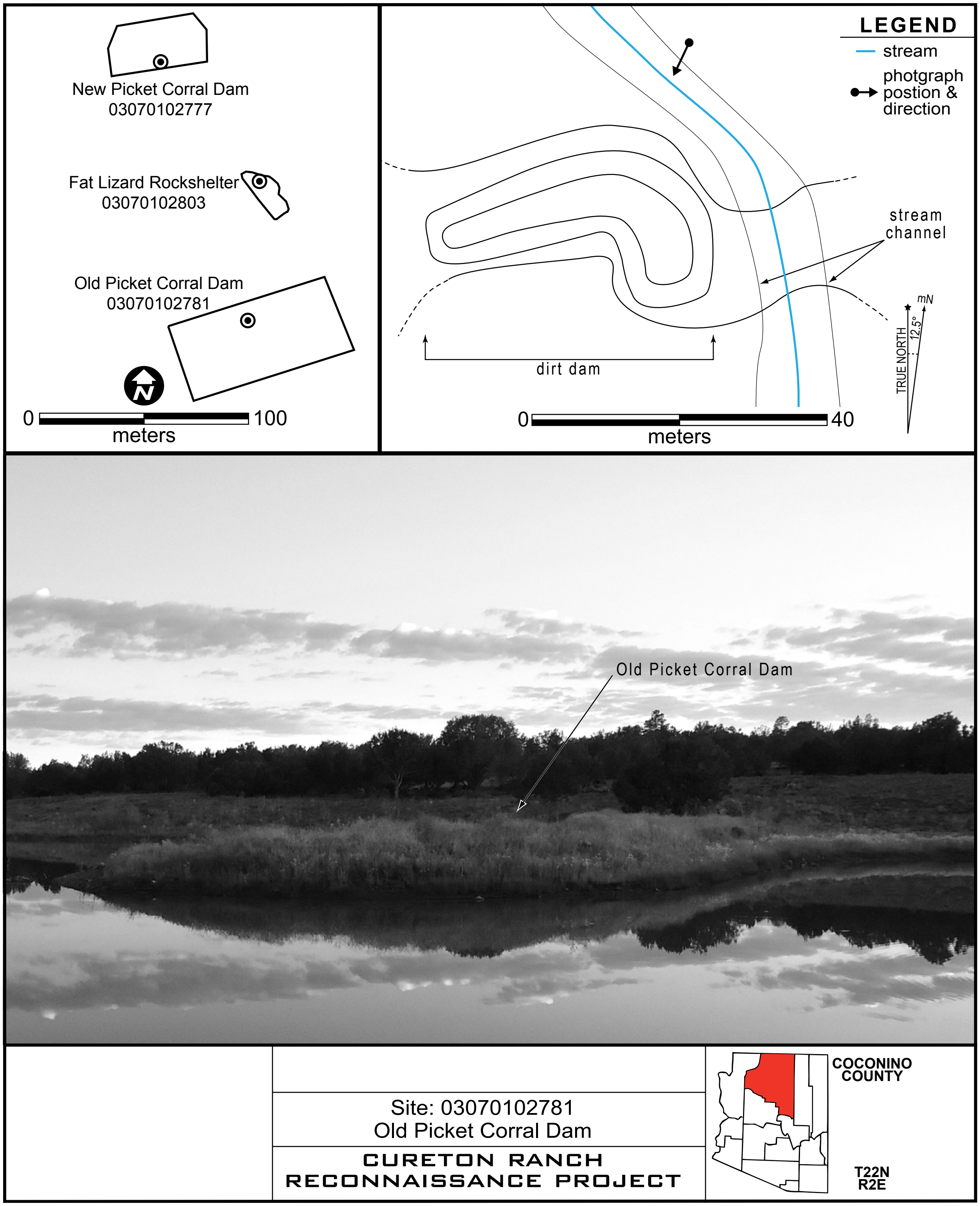


Figure A.18. Site 03070102781 map.

Community, a Cohonina community surrounding the Pittsberg Fort located on the Northeastern flank of Pittsberg. MSTD dates this site to the mid 11th century (A.D. 1041 ± 42 years).

Site 03070102783 is comprised of a low density artifact scatter containing ceramics, chipped stone and groundstone. The site is located at the base of Pittsberg on its northeastern flank. Approximately 150 ceramic sherds are present including the following wares/types: Floyd/Deadmans Gray and Undifferentiated San Juan Red Ware. Lithic material consists of approximately 75 secondary flakes representing the following material types: Kaibab chert, Government Mountain obsidian, and an unknown fine grained volcanic. Groundstone present includes fragments of Coconino sandstone. Conglomerate derived sandstone is also present at this site.

03070102784 is a Cohonina, Coconino phase, site located on the Cureton Ranch (Figure A.19). The site has been impacted by a modern work camp, ranching and casual collection. This logistical site is located at about 2,040m in elevation and is in Great Basin Conifer woodland. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the Northeastern flank of Pittsberg. MSTD dates this site to the late 10th century (A.D. 991 ± 42 years).

Site 03070102784 is comprised of a basalt cobble mound and a low density artifact scatter containing ceramics, chipped stone and groundstone. The site is located at the base of Pittsberg on its northeastern flank. Approximately 300 ceramic sherds are present including the following wares/types: Floyd/Deadmans Gray, Floyd Black-on-grey, Deadmans Black-on-grey and. Approximately 35% of a Floyd Black-on-grey with Fugitive Red exterior bowl is located at the Southern end of the site. Lithic material consists of approximately 500 secondary flakes representing the following material types: Kaibab chert, Government Mountain obsidian and Partridge Creek volcanics. Groundstone present includes fragments of Coconino sandstone. Features 1 and 2 consist of high density artifact scatters. Feature 3 consists of a small circular mound of basalt cobbles measuring 2m by 2m, but is of unknown cultural affiliation.

03070102785 is a Euro-American late historic ranching site located on the present-day Cureton Ranch (Figure A.20). Modern ranching impacts this site. This site is located at about 2,040m in elevation and is in Great Basin Conifer woodland. This site was constructed by the Cureton's, a family that has resided in Williams, Arizona since 1905. Cureton family oral history and artifacts date the construction of this site on the Cureton Ranch to the middle of the 20th century (A.D. 1950-1959).

Site 03070102785 is comprised of a collapsed stick-frame house, a stable, a corral, an outhouse, five derelict automobiles, a fence line, a two-track road and a low density scatter of historic artifacts. Feature 1 is a stable and adjacent paddock constructed of salvaged timber measuring approximately 30m by 20m. Feature 2 is a partially collapsed corral with an entrance on the east side. It is constructed of locally cut juniper and measures 10m by 20m. Feature 3 is a fence line to the east of the corral and consists of approximately 12 wooden posts hewn from

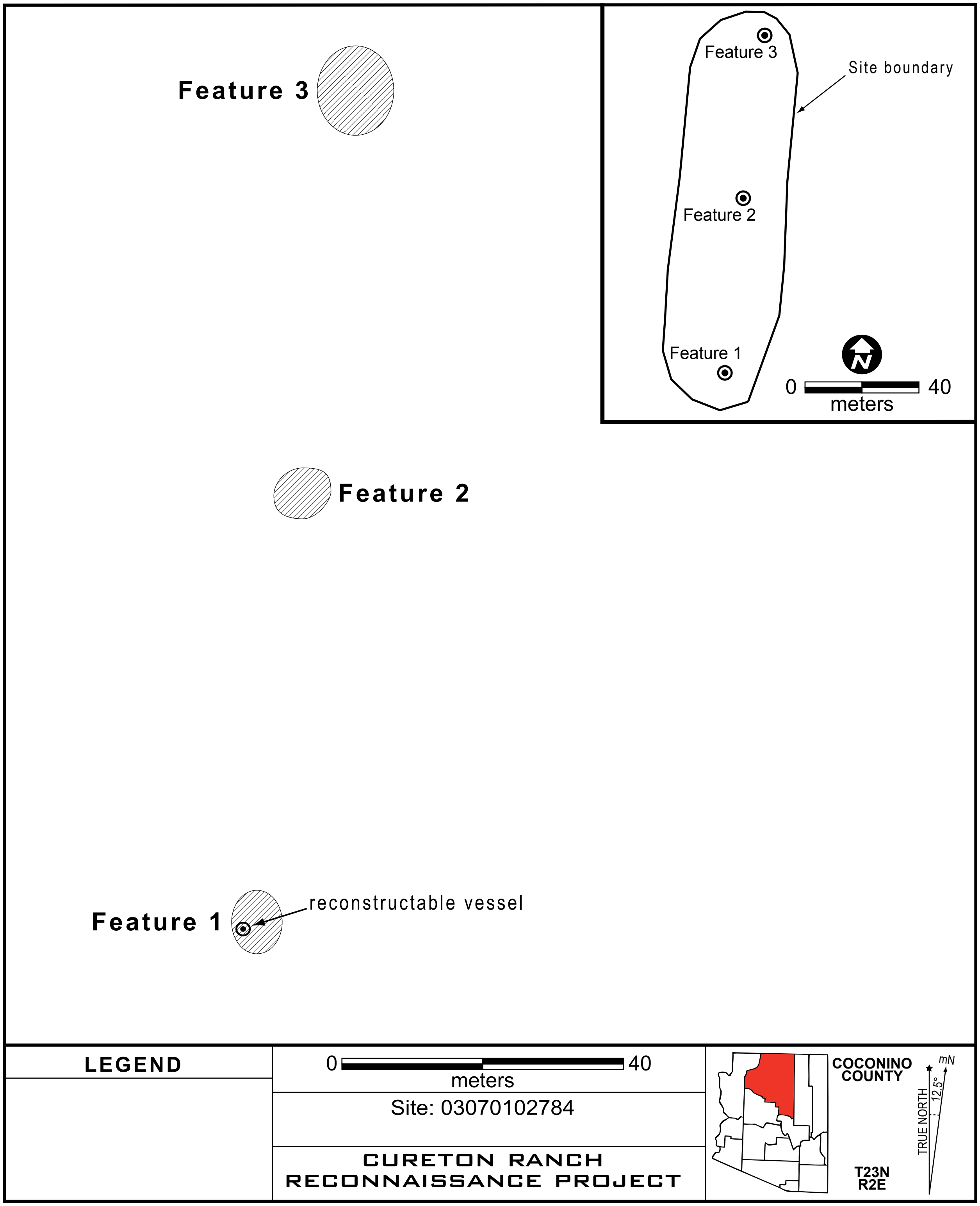


Figure A.19. Site 03070102784 sketch map.

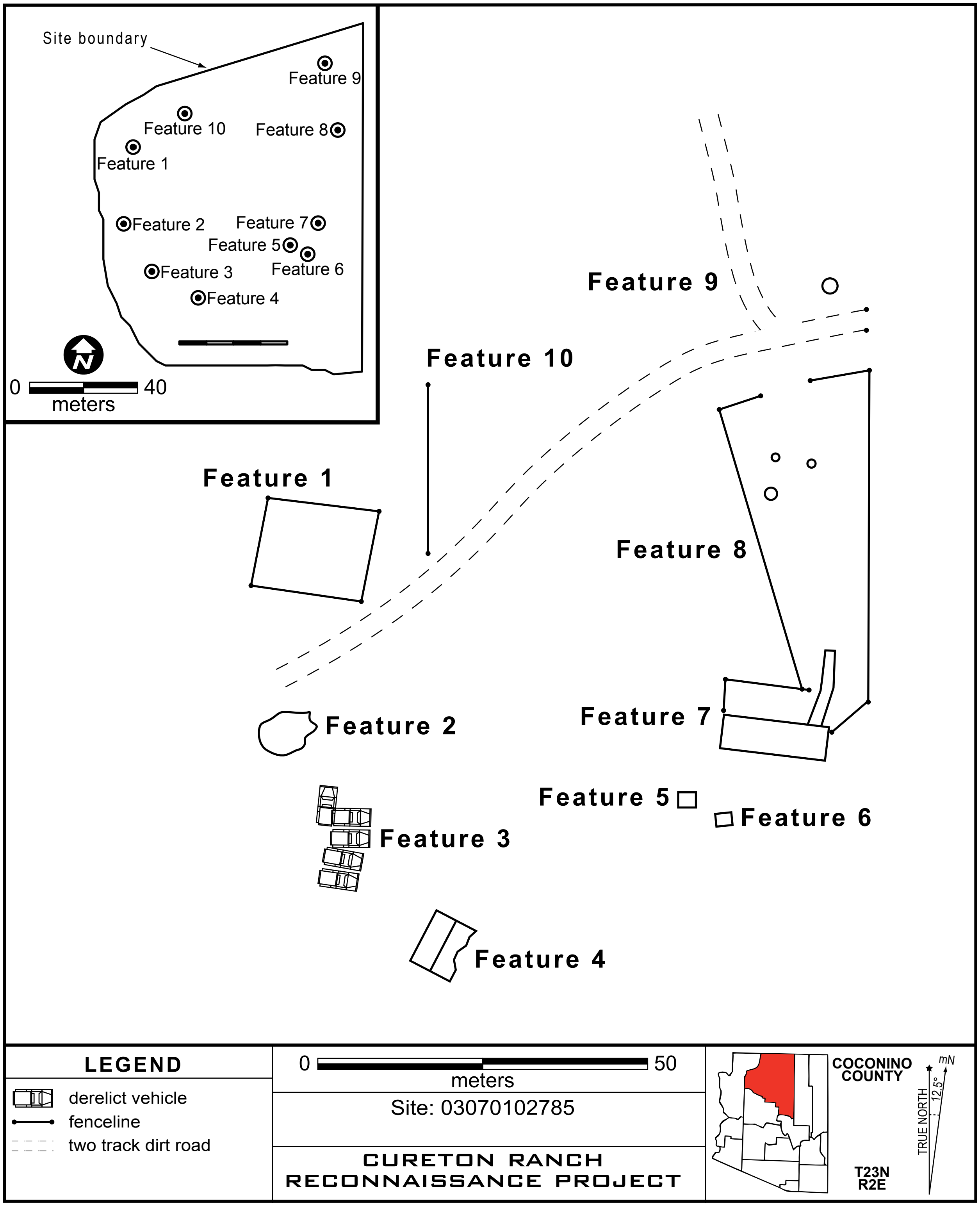


Figure A.20. Site 03070102785 sketch map.

local juniper. No wire is present. Feature 4 is a stick-frame house that is partially collapsed and measures approximately 10m by 20m.

03070102786 is a Cohonina, Medicine Valley phase, site located on Kaibab National Forest and Cureton Ranch lands (Figure A.21). The habitation site has been impacted by ranching and casual collection. This habitation site is located at about 2,040m in elevation and is in Great Basin Conifer woodland. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the Northeastern flank of Pittsberg. MSTD dates this site to the early 11th century (A.D. 1017 ± 42 years).

Site 03070102786 is comprised of two features and an associated artifact scatter. The site is located on top of small ridge on the northeastern slope of Pittsberg. Approximately 1,000 ceramic sherds are present including the following wares/types: Floyd/Deadmans Gray, Floyd Black-on-grey, Undifferentiated Tusayan Gray Ware, Black Mesa Black-on-white and Undifferentiated Tsegi Orange Ware. Lithic material consists of approximately 1,500 flakes representing the following material types: Kaibab Chert, Government Mountain obsidian, Partridge creek volcanics, and Perkinsville jasper. Groundstone present includes two basalt hammerstones and fragments of Coconino sandstone. Conglomerate derived sandstone is also present at this site. Feature 1 consists of a shallow circular depression 8m in diameter. Bitter Condalia bushes are present on its margin. Feature 2 consists of a linear rock alignment approximately 8m long.

03070102788 is a Cohonina, Hull phase, site located on Kaibab National Forest lands. The site has been impacted by ranching and casual collection (Figure A.22). This habitation site is located at about 2,040m in elevation and is in Great Basin Conifer woodland. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the northeastern flank of Pittsberg. MSTD dates this site to the mid 11th century (A.D. 1138 ± 42 years).

Site 03070102788 is comprised of one feature and an associated artifact scatter. The site is located at the base of a ridge on the southeastern slope of Pittsberg. Approximately 20 ceramic sherds are present including the following wares/types: Floyd/Deadmans Gray. Lithic material consists of approximately 100 secondary flakes representing the following material types: Kaibab Chert. Groundstone present includes a metate (basin and flat/concave) and a mano (trough type), both made of Coconino sandstone. A small alignment of Coconino sandstone is located Southwest of the structure. Conglomerate derived sandstone is also present at this site. Feature 1 consists of a mounded area 15-20cm high lined with basalt and tabular conglomerate cobbles, representing a single room structure. The structure is sub-rectangular in plan view and measures 3m north to south by 4m east to west.

03070102790 (NA2790) is a previously recorded site. It is a Cohonina, Coconino to Hull phase, rock art site located on Kaibab National Forest lands (Figure A.23). The site has been impacted by ranching and recent modern dumping. This site is located at about 2,070m in elevation and is Great Basin Conifer woodland. This rock art is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the Northeastern flank of Pittsberg. A lack

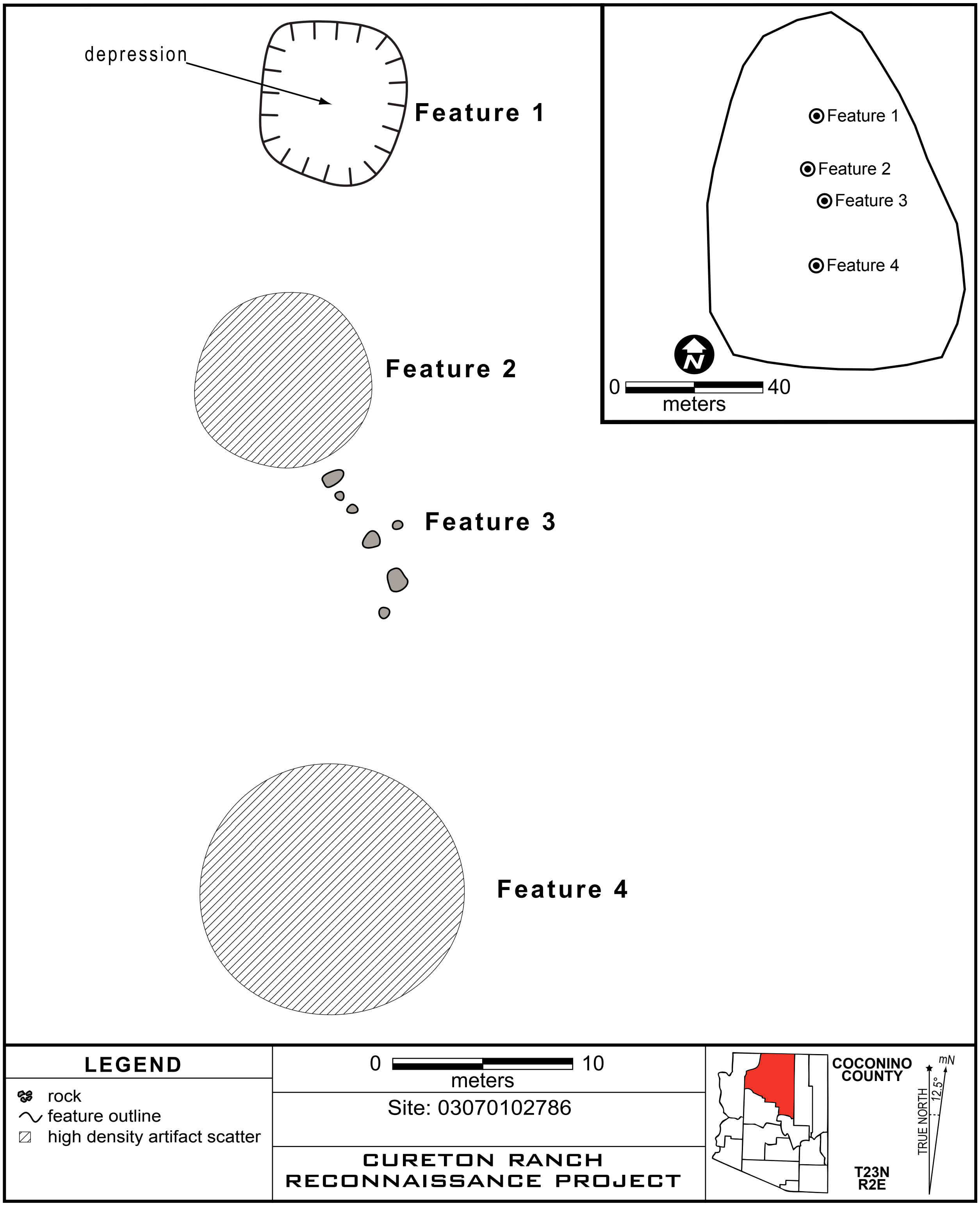


Figure A.21. Site 03070102786 sketch map.

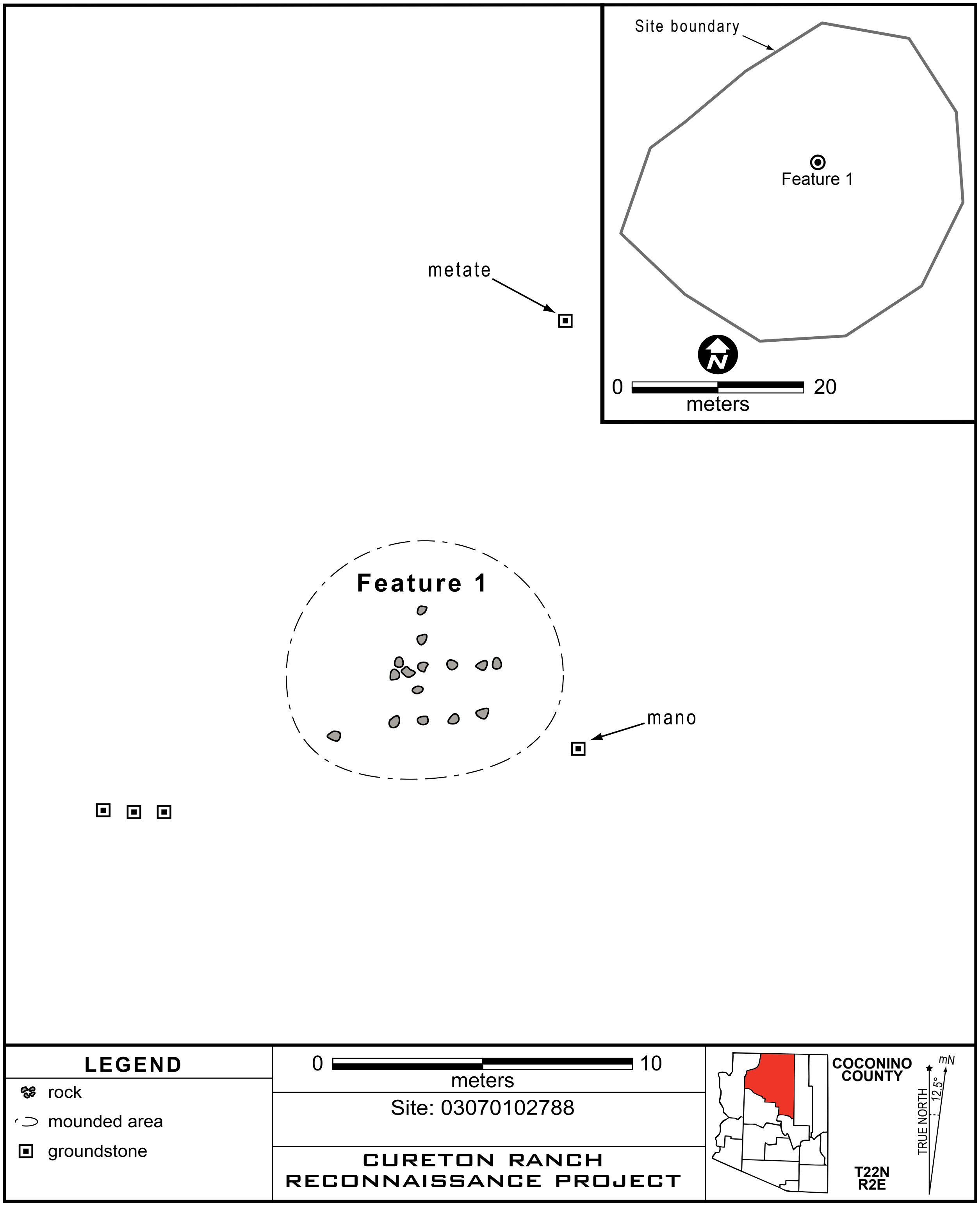


Figure A.22. Site 03070102788 sketch map.

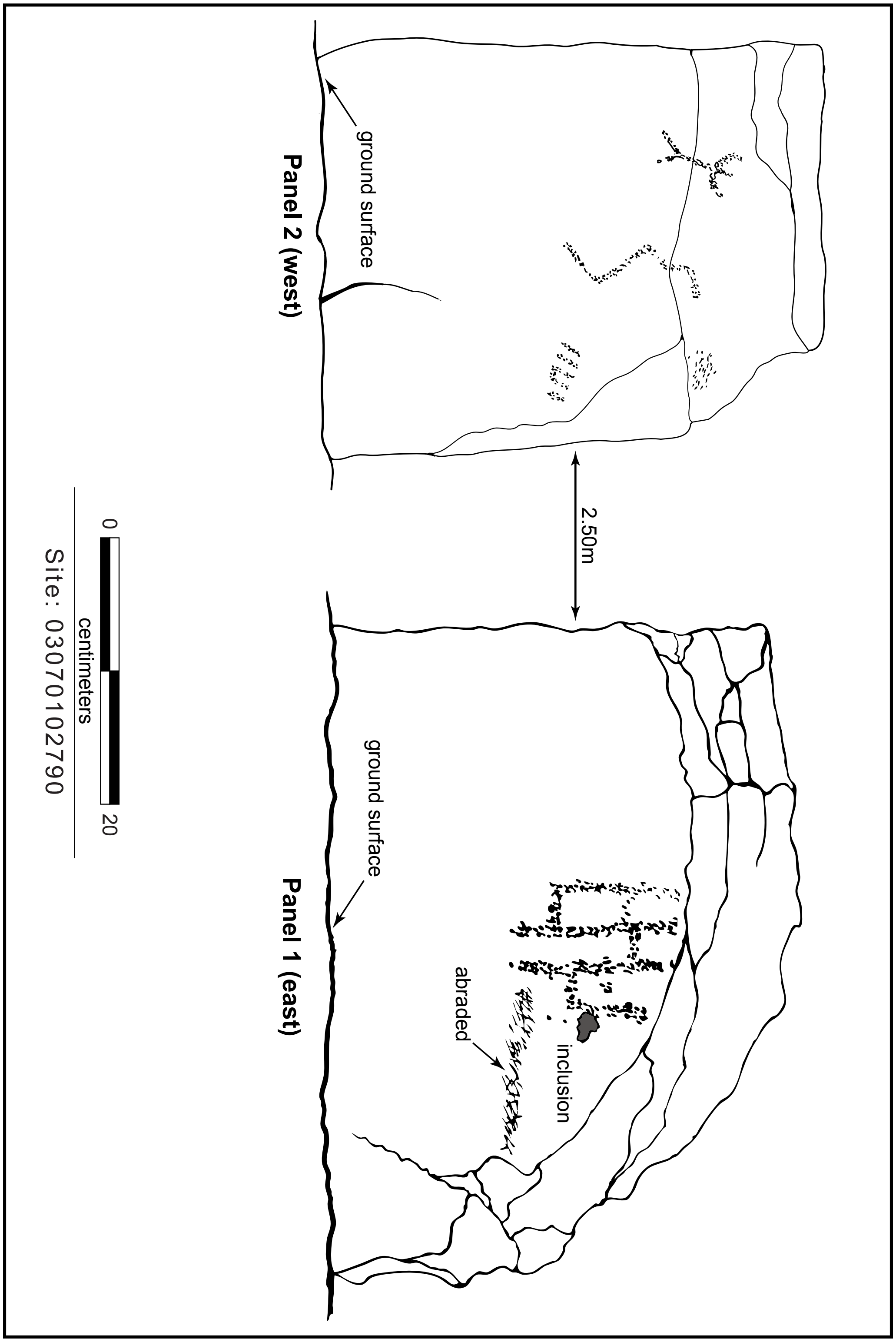


Figure A.23. Sketches of rock art panels at Site 03070102790.

of artifacts prevents placement of this site into the local cultural or chronological sequence using index wares and tree-ring dated ceramics. However, the morphological characteristics of the rock art elements suggest a Cohonina affiliation (Christenson 2004) and a Pueblo II temporal assignment (A.D. 900-1150) (Christenson 2004).

Site 03070102790 consists of two petroglyph panels on a run of basalt bedrock striking west-northwest, on the south slope of Pittsberg. Panel 1 consists of one rectilinear pecked and scratched element and one abraded surface. The panel is oriented vertically and faces 192 degrees south. Panel 2 is located one meter west of panel 1 and consists of four pecked and scratched elements: a stickman, zigzag line and two ovoid solids. The panel is oriented vertically and faces 230 degrees southwest.

MNA site files indicate site 03070102790 is MNA site NA3597. A photograph of a stickman element at site NA3597 taken during the 1938 MNA expedition matches exactly the stickman element recorded at site 03070102790, Panel 2. NA3597 was recorded by Milton Wetherill on August 8, 1938 as part of the 1938 MNA expedition to sites north of Williams, Arizona.

03070102791 is a Cohonina, Coconino to Hull phase, rock art site located on Kaibab National Forest lands (Figure A.24). This site is located at about 2,090m in elevation and is Great Basin Conifer woodland. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the northeastern flank of Pittsberg. A lack of artifacts prevents placement of this site into the local cultural or chronological sequence using index wares and tree-ring dated ceramics. However, the morphological characteristics of the rock art elements suggest a Cohonina affiliation (Christenson 2004) and Pueblo II temporal assignment (A.D. 900-1150) (Christenson 2004).

Site 03070102791 consists of one petroglyph panel at the base of a basalt cliff, on the south slope of Pittsberg. Panel 1 consists of 14 pecked and scratched elements on a surface approximately 1.75m long and 50cm wide. Recognizable elements include a stickman, a curvilinear scroll, star bursts, an anthropomorph, crosses, a zoomorph with horns and other amorphous elements. The panel is oriented skyward and faces 196 degrees south.

03070102792 is a Cohonina, Medicine Valley phase, site located on the Cureton Ranch. The site has been impacted by, ranching and casual collection. This logistical site is located at about 2,030m in elevation and is in Great Basin Conifer woodland. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the northeastern flank of Pittsberg. MSTD dates this site to the mid 11th century (A.D. 1139 ± 42 years).

Site 03070102792 is comprised of a low density artifact scatter containing ceramics, chipped stone and two projectile points. The site is located at the base of Pittsberg on its northwestern flank. Approximately 100 ceramic sherds are present including the following wares/types: Floyd/Deadmans Gray, Floyd/Deadmans Fugitive Red, Deadmans Black-on-grey, and Undifferentiated Tusayan Gray Ware. Lithic material consists of approximately 50 secondary flakes representing the following material types: Kaibab chert, undifferentiated obsidian, and quartz. A Kahorsho Serrated style (A.D. 950 to 1150) projectile point made of Government

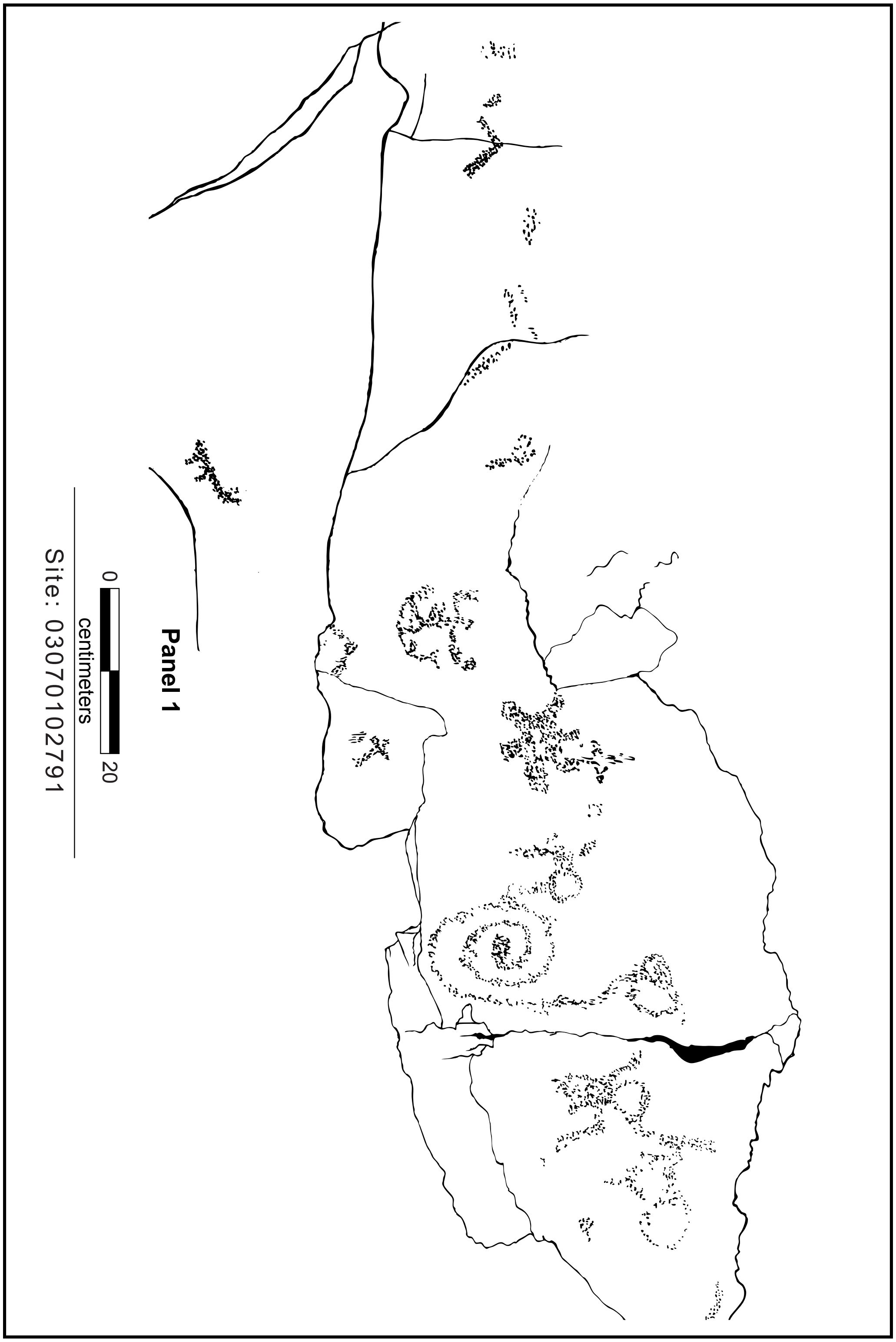


Figure A.24. Sketches of rock art panel at Site 03070102791.

Mountain obsidian is located near the center of the site. A Red Lake Nonserrated style (A.D. 1000 to 1075) projectile point was also noted at the site.

03070102793 is a Cohonina, Hull phase, site located on the Cureton Ranch. The site has been impacted by, ranching and casual collection. This logistical site is located at about 2,010m in elevation and is in Great Basin Conifer woodland. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the northeastern flank of Pittsberg. MSTD dates this site to the mid 11th century (A.D. 1135 ± 42 years).

Site 03070102793 is comprised of an artifact scatter containing ceramics, chipped stone, and groundstone. The site is located at the base of Pittsberg on its northwestern flank. Approximately 600 ceramic sherds are present representing the following wares/types: Floyd/Deadmans Gray, Floyd/Deadmans Fugitive Red, Undifferentiated Tusayan Gray Ware and Black Mesa Black-on-white. Lithic material consists of approximately 75 secondary flakes representing the following material types: Kaibab chert and Government Mountain obsidian. Groundstone is also present and consists of approximately 10 fragments of Coconino sandstone.

03070102794 is a logistical site of unknown cultural affiliation located on Kaibab National Forest lands. The site has been impacted by ranching. This site is located at about 2,010m in elevation and is in Great Basin Conifer woodland. This site may be part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the northeastern flank of Pittsberg. A lack of temporally diagnostic artifacts prevents placement of this site into the local cultural or chronological sequence. However, the characteristics of the site and its proximity to known Cohonina sites, suggest a Cohonina affiliation.

Site 03070102794 is comprised of an artifact scatter containing, chipped stone and groundstone. The site is located at the base of Pittsberg on its northwestern flank. Lithic material consists of approximately 50 secondary and tertiary flakes representing the following material types: Government Mountain obsidian. Groundstone present consists of approximately 50 fragments of Coconino sandstone.

03070102795 is a Cohonina, Medicine Valley phase, site located on the Cureton Ranch. The site has been impacted by ranching and casual collection. This logistical site is located at about 2,010m in elevation and is in Great Basin Conifer woodland. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the northeastern flank of Pittsberg. MSTD dates this site to the mid 11th century (A.D. 1035 ± 42 years).

Site 03070102795 is comprised of an artifact scatter containing ceramics, chipped stone, and a biface. The site is located at the base of Pittsberg on its northwestern flank. Approximately 150 ceramic sherds are present including the following wares/types: Floyd/Deadmans Gray, Floyd/Deadmans Fugitive Red and Undifferentiated Tusayan Gray Ware. Lithic material consists of approximately 400 secondary flakes representing the following material types: Kaibab chert, Government Mountain obsidian, Presley Wash obsidian, chalcedony, and Perkinsville jasper. A small spent core of Presley Wash obsidian is present as is an incomplete bifacial tool made of Kaibab chert that measures 50 millimeters long by 40 millimeters wide by 6 millimeters thick.

03070102796 is a Cohonina, Hull phase, site located on the Cureton Ranch. The site has been impacted by, ranching and casual collection. This logistical site is located at about 2,010m in elevation and is in Great Basin Conifer woodland. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the northeastern flank of Pittsberg. MSTD dates this site to the mid 12th century (A.D. 1150 ± 42 years).

Site 03070102796 is comprised of an artifact scatter containing ceramics, chipped stone, a projectile point, and groundstone. The site is located at the base of Pittsberg on its northwestern flank. Approximately 50 ceramic sherds are present including the following wares/types: Floyd/Deadmans Gray, Deadmans Black-on-grey, Moenkopi Corrugated, Undifferentiated Tusayan Gray Ware, and Undifferentiated Tusayan White Ware. Lithic material consists of approximately 125 secondary flakes representing the following material types: Kaibab chert, Government Mountain obsidian, Presley Wash obsidian, and Partridge Creek volcanics. A Redlake non-Serrated (A.D. 1000 to 1075) style projectile point made of Kaibab chert is located near the center of the site. A single piece of Coconino sandstone is only groundstone present at the site.

03070102797 is a logistical site of unknown cultural affiliation located on Kaibab National Forest lands. The site has been impacted by ranching. This site is located at about 2,010m in elevation and is in Great Basin Conifer woodland. This site may be part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the Northeastern flank of Pittsberg. A lack of temporally diagnostic artifacts prevents placement of this site into the local cultural or chronological sequence. However, the characteristics of the site and its proximity to known Cohonina sites suggest a Cohonina affiliation.

Site 03070102797 is comprised of an artifact scatter containing chipped stone and groundstone. The site is located at the base of Pittsberg on its northeastern flank. Lithic material consists of a single core of Kaibab chert measuring 14cm by 10cm by 9cm. Groundstone present consists of approximately 50 fragments of Coconino sandstone split between two concentrations. Conglomerate derived sandstone is also present at this site.

03070102798 is a logistical site of unknown cultural affiliation located on the Cureton Ranch. The site has been impacted by ranching. This site is located at about 2,060m in elevation and is in Great Basin Conifer woodland. This site may be part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the northeastern flank of Pittsberg. A lack of temporally diagnostic artifacts prevents placement of this site into the local cultural or chronological sequence. However, the characteristics of the site and its proximity to known Cohonina sites suggest a Cohonina affiliation.

Site 03070102798 is comprised of an artifact scatter containing chipped stone. The site is located at north of Pittsberg on the toe of a lava flow emanating from its northeastern flank.

Lithic material consists of approximately 100 primary, secondary, and tertiary flakes; and shatter. Government Mountain Obsidian is the only material type present with the exception of a single primary flake of Kaibab chert.

03070102799 is a logistical site of unknown cultural affiliation located on the Cureton Ranch. The site has been impacted by casual collection and ranching. This site is located at about 2,020m in elevation and is in Great Basin Conifer woodland. This site may be part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the northeastern flank of Pittsberg. A lack of temporally diagnostic artifacts prevents placement of this site into the local cultural or chronological sequence. However, the characteristics of the site and its proximity to known Cohonina sites suggest a Cohonina affiliation.

Site 03070102799 is comprised of a rock ring and associated artifact scatter containing chipped stone and groundstone. The site is located at north of Pittsberg on the toe of a lava flow emanating from its northeastern flank. Lithic material consists of approximately 150 secondary and tertiary flakes representing the following material types: Kaibab chert and Government Mountain obsidian. Groundstone at the site consists of three small pieces of Coconino sandstone, of which one was recognizable as a mano fragment. Feature 1 consists of a rock ring measuring 130cm in diameter and constructed of five basalt cobbles averaging 20cm across.

03070102800 is a Cohonina, Hull phase, site located on the Cureton Ranch (Figure A.25). The site has been impacted by ranching and casual collection. This habitation site is located at about 2,020m in elevation in Great Basin Conifer woodland. An isolated stand of ponderosa pine is south of the site. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the northeastern flank of Pittsberg. MSTD dates this site to the mid 12th century (A.D. 1142 ± 42 years).

Site 03070102800 is comprised of one feature and an associated artifact scatter. The site is located on the Northwest toe of a basaltic lava flow emanating from Pittsberg. Approximately 1,000 ceramic sherds are present including the following wares/types: Floyd/Deadmans Gray, Undifferentiated Tusayan Gray Ware, and Shato Black-on-white. Lithic material consists of approximately 700 secondary and tertiary flakes representing the following material types: Kaibab chert and Government Mountain obsidian. Groundstone present consists of a partial mano (trough type) made of Coconino sandstone. Feature 1 consists of a circular masonry structure constructed of basalt cobbles averaging 20cm across. The structure measures approximately 6m east to west by 5m north to south and a maximum rubble height of 25cm. The structure incorporates the basalt bedrock of the lava toe into its south wall and has an opening on its north side.

03070102801 is a Cohonina, Coconino to Hull, site located on the Cureton Ranch. The site has been impacted by erosion, ranching and casual collection. This logistical site is located at about 2,030m in elevation and is in Great Basin Conifer woodland. This site may be part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the

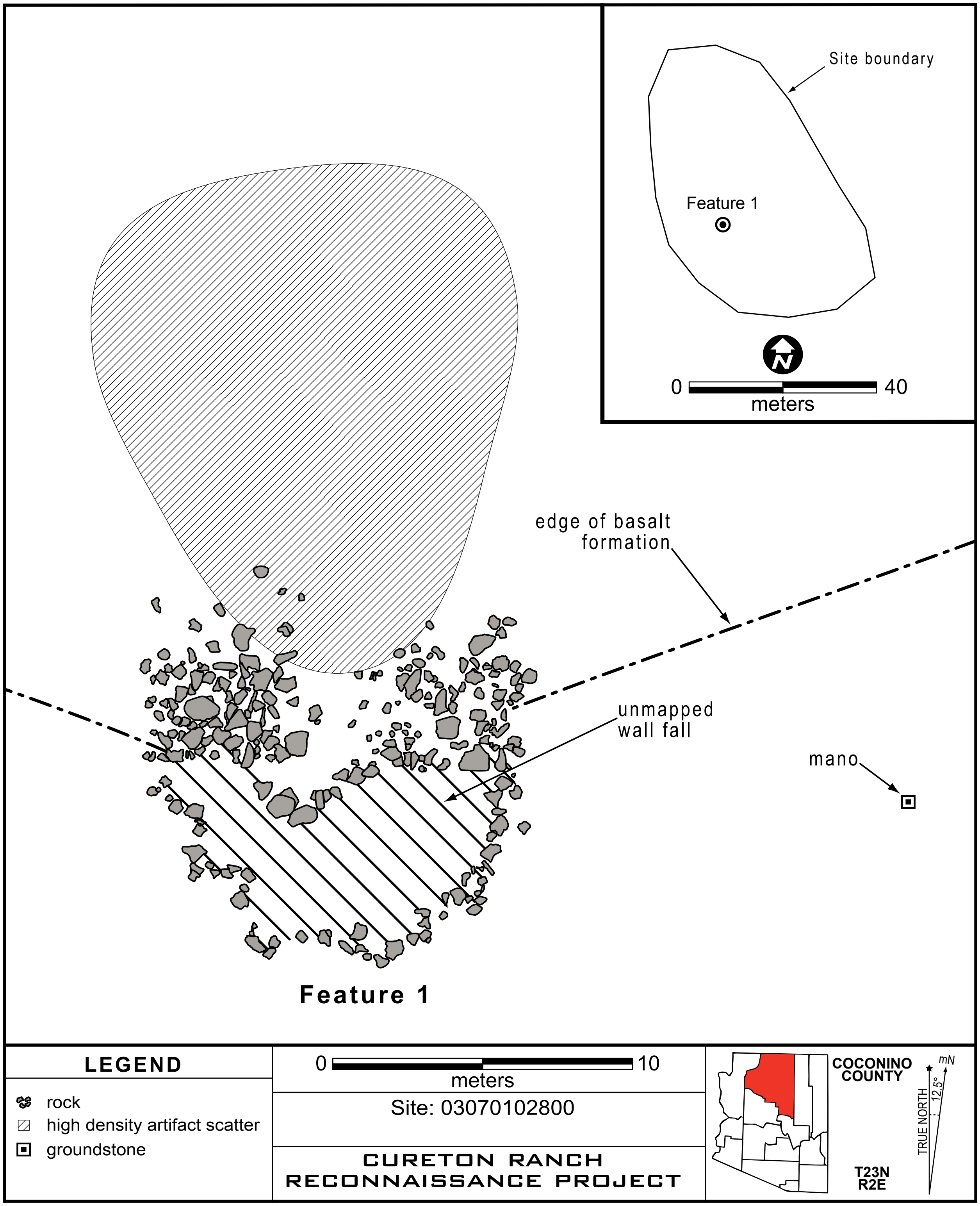


Figure A.25. Site 03070102800 sketch map.

Northeastern flank of Pittsberg. CCD dates this site from the first part of 9th century through the 12th century (A.D. 800 to 1200).

Site 03070102801 is comprised of an artifact scatter containing ceramics and groundstone. The site is located along a small wash on exposed bedrock, north-northeast of Pittsberg. Approximately 50 ceramic sherds are present including the following wares/types: Floyd/Deadmans Gray. A single piece of Coconino sandstone is only groundstone present at the site. The position of the artifact scatter within the wash suggests these artifacts actually originate from a site or sites at the base of the Dolly Parton Hills lying to the northeast.

03070102802 is a Basketmaker II site located on Kaibab National Forest and Cureton Ranch lands. The site has been impacted by erosion, ranching and casual collection. This logistical site is located at about 1,990m in elevation and is in Great Basin Conifer woodland. This site is part of the late Archaic to Formative period hunter-gatherer occupation of the Coconino Plateau. Projectile point seriation dates this site from the ninth century B.C. through the third century A.D. (B.C. 800 to A.D. 300).

Site 03070102802 is comprised of an artifact scatter containing chipped stone and groundstone. The site is located along Cataract Creek on exposed bedrock Southwest of Pittsberg. Approximately 2,500 flakes representing all stages of reduction except cores are present. Shatter is in great abundance as are formal tools and utilized flakes. The following lithic materials are present at the site: Kaibab chert, Government Mountain obsidian, Presley Wash Obsidian, Black Tank obsidian and Partridge Creek volcanics. Seven partial bifaces made of Government Mountain Obsidian are present at the site. The bases of two Western Basketmaker II style projectile point made of Black Tank obsidian are also present at the site. A heavily retouched Western Basketmaker II style projectile point of Kaibab chert was also noted approximately 300m downstream of the site. A single, small and heavily eroded Floyd/Deadmans Gray sherd is the only ceramic material present at the side.

03070102803 (NA3591), Fat lizard Rock Shelter is a previously recorded site. It is a Cohonina Coconino phase, site located on the Cureton Ranch (Figure A.26). The site has been impacted by erosion, mining, ranching, excavation, and casual collection. The site is located at about 1,990m in elevation in Great Basin Conifer woodland. An isolated stand of ponderosa pine lies to the north and downstream of the site. This site is part of the Pittsberg Community, a Cohonina community surrounding the Pittsberg Fort located on the northeastern flank of Pittsberg. MSTD dates this site to the early 11th century (A.D. 1010 ± 42 years).

Site 03070102800 is comprised of small rockshelter with an associated rockart panel and an associated artifact scatter. The site is located in a basalt cliff that makes up the eastern bank of Cataract Creek. Approximately 1,000 ceramic sherds are present including the following wares/types: Floyd/Deadmans Gray, Floyd/Deadmans Fugitive Red, Floyd Black-on-grey, and Deadmans Black-on-grey. Lithic material consists of approximately 800 secondary and tertiary flakes representing the following material types: Kaibab chert, Government Mountain obsidian, chalcedony, and Perkinsville jasper. Groundstone present consists of a partial mano (trough

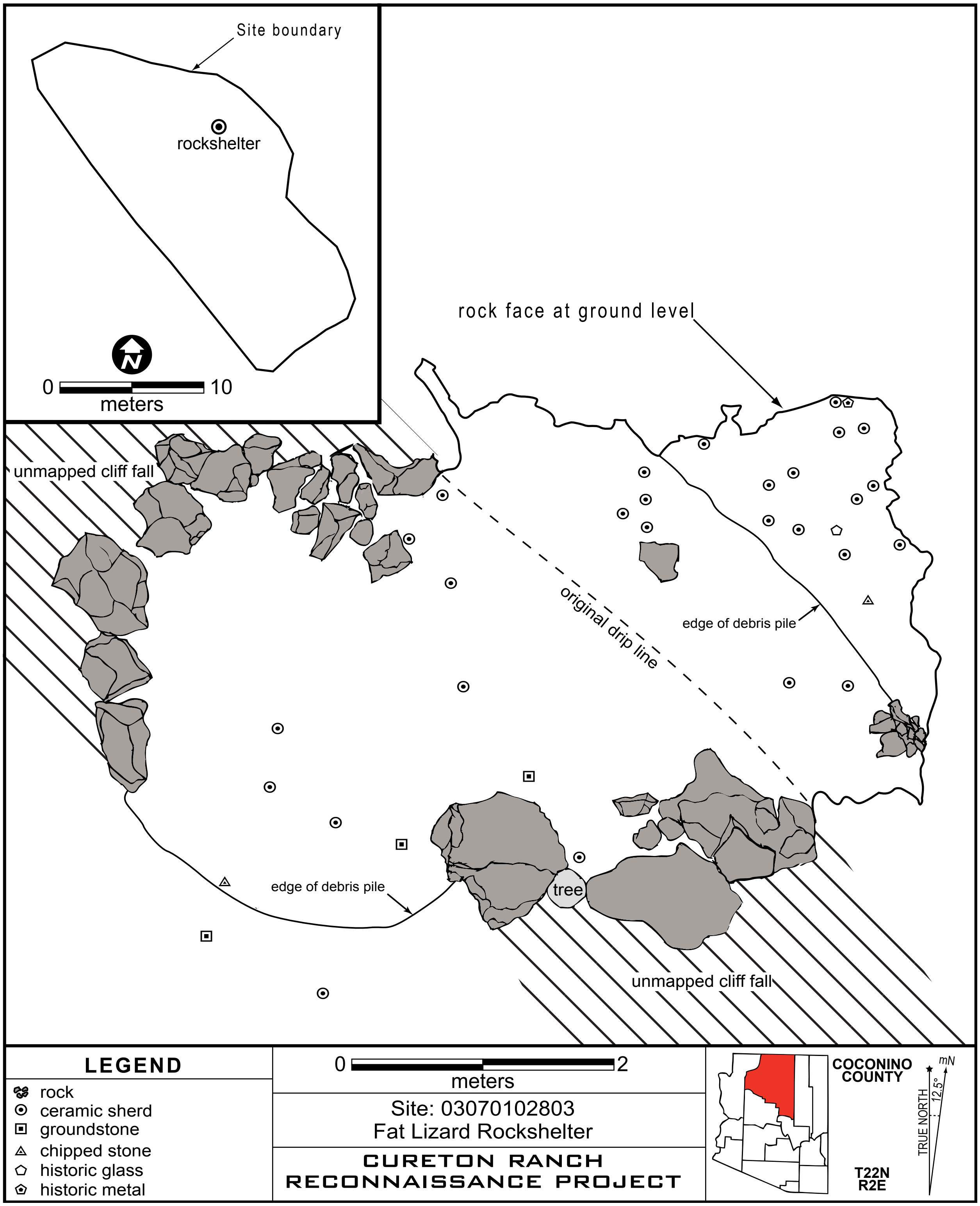


Figure A.26. Site 03070102803.

type) made of Coconino sandstone, fragments of Coconino sandstone, and a mano (trough type) made of vesicular basalt.

The rockshelter consists of large lacuna in the basalt flow that makes up the cliff bedrock. Down cutting of Cataract creek bisected this lacuna creating the rockshelter observable today. The rockshelter is located approximately 6m above the creek bottom, placing it well above the flood line. In the early 1970s to 1980s blasting associated with a rock quarry above the rockshelter weakened the cliff face resulting in the partial collapse of the rockshelter ceiling. Ceiling fall removed from the rockshelter by the land owners suggests the depth of the rockshelter prior to collapse was about 3.75m from the drip line to its deepest point. The depth today is about 2.5m. The width and height of the rockshelter today is approximately 4.25 and 1.5m respectively. Large blocks of detached cliff face flank the rockshelter on either side.

In 2006 the landowners excavated a road cut to access the New Picket Corral Dam just downstream of the rockshelter. This activity revealed a 3 meter deep profile immediately in front of the rockshelter. There were three strata present in the profile. Stratum C is the basal layer consisting of a sterile, uniform, basalt derived orange-brown clay. It is highly compacted and contains small to large pebbles of angular and rounded basalt originating from the cliff face and stream bed. Stratum B consists of a dark brown silt. It is moderately compacted, containing artifacts and fractured pieces of basalt originating from the cliff face. Stratum A consists of light brown silt of light compaction containing a high volume of organic material and fractured rock. This stratum is eroded material originating from the cliff top.

Rockart panel 1 (Figure A.27) is located south (upstream) from the rockshelter on the east cliff of Cataract Creek. It consists of three pecked and scratched elements including an anthropomorph, a cross, and an incomplete figure that has been truncated by a broken edge of the panel. The panel is tilted slightly skyward and faces south-southwest.

MNA site files indicate the Fat Lizard Rockshelter is MNA site NA3591. Site location descriptions provided by Colton (1946:222) and MNA site cards match the location of the Fat Lizard Rockshelter. NA3597 was recorded by Milton Wetherill and Al Schroeder on July 9, 1938 as part of the 1938 MNA expedition to sites north of Williams, Arizona. Schroeder and Robert Solenberger subsequently excavated a test pit in the rockshelter. They recovered a number of artifacts including manos, projectile points, drills, a lithic core, and a ceramic tool. Colton (1946:222) reports the cultural deposits are approximately 23cm thick. Horn-Wilson (1997:135) identified one of the projectile points as a Desert Side Notched style (A.D. 1300 to 1600) of obsidian.

03070102804 is a Late Historic Euro-American road located on the Cureton Ranch (Figure A.28). The site has been impacted by erosion, modern ranching and road building. This site traverses terrain varying from 1,970m in elevation to as high as 2,030m in elevation. The site is located in Great Basin Conifer woodland. This site is part of Late Historic road building associated with ranching and lumbering on the Coconino Plateau. Historic documents date this site to the early part of the 20th century (A.D. 1900-1920).

Site 03070102804 is comprised of the Old Canyon Highway that originated in Williams, Arizona and terminated at Grand Canyon Village, Arizona. The section of the road located

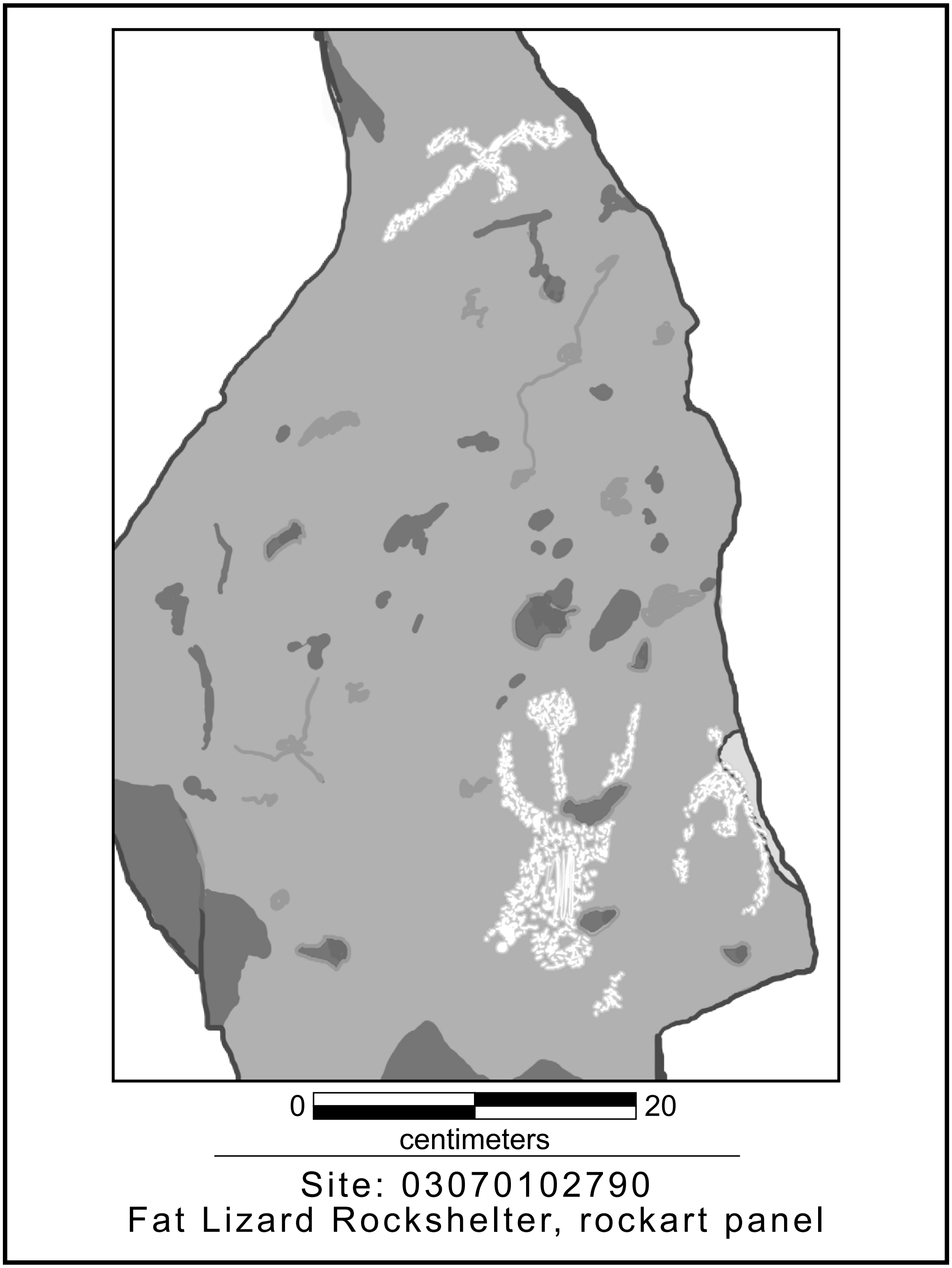


Figure A.27. Sketch of rock art panel at Site 03070102803.

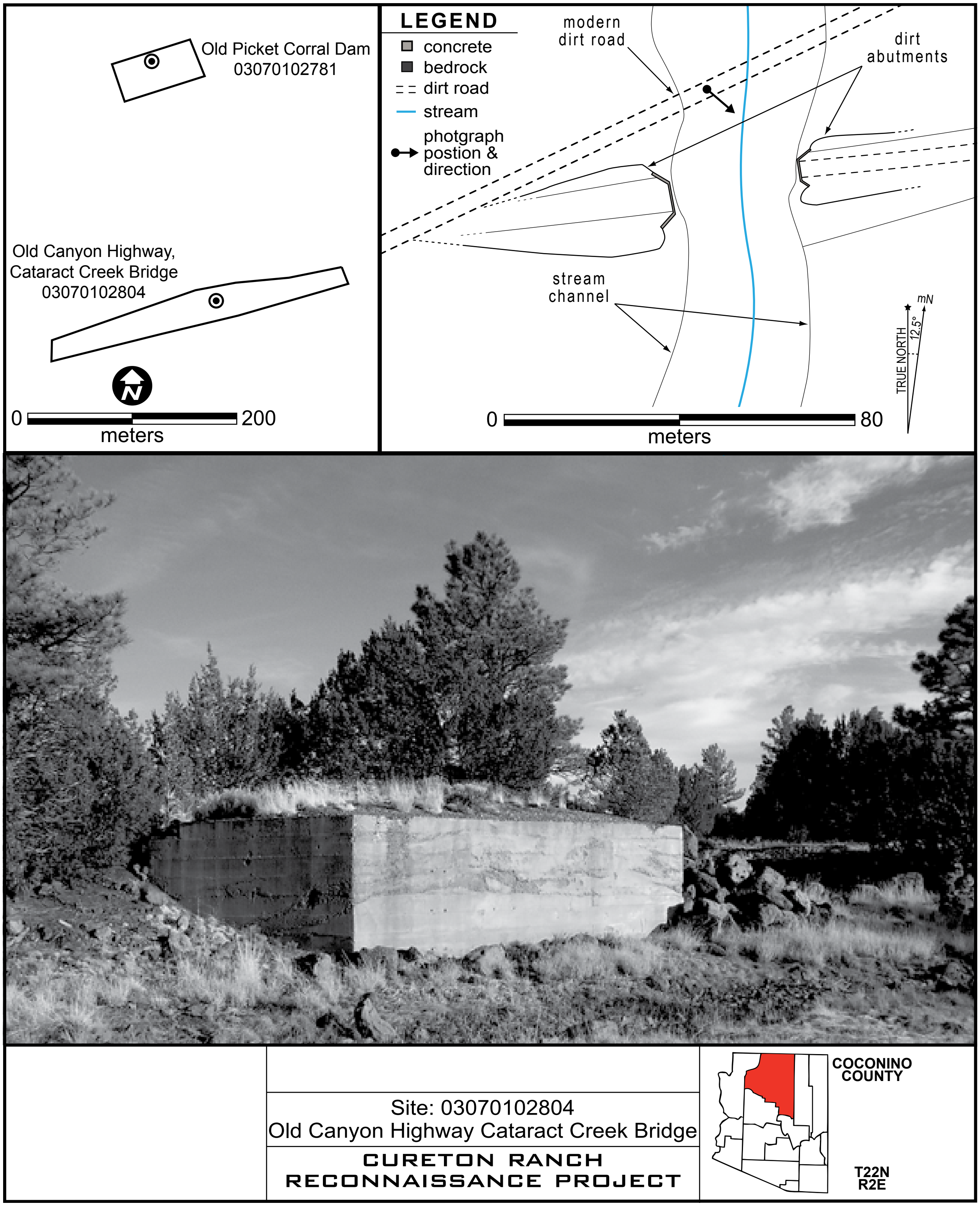


Figure A.28. Site 03070102804.

on the Cureton Ranch consists of a graded dirt road averaging approximately 4.5m in width. Erosion and construction activity have destroyed much of the road, but some portions are still relatively intact. The remains of a bridge are present where the Old Canyon Highway crossed Cataract Creek below the confluence of Cataract Creek and Dogtown Wash. The bridge consists of graded dirt approaches terminating at concrete bridge abutments. The maximum width of the construction is approximately 6m at the base of the concrete abutments. The abutments are approximately 3m in height. While the approaches and abutments of the bridge are intact the actual span was removed or destroyed (time interval unknown).

APPENDIX B

Chronological Data

This appendix contains the results of the archaeological chronological methods employed during the course of the Cureton Ranch Reconnaissance Project (CRRP). Ceramic Cross Dating (CCD) results are presented in the form of chronograms for each site encountered during the CRRP for which a ceramic assemblage existed as well as those sites considered during subsequent analyses (Figures 2 to 54). Production ranges and appropriate references for individual types used in ceramic cross dating are presented in Table B.1. The references in Table B.1 also point to appropriate literature containing formal definitions of each of the ceramic types mentioned in this thesis. Mean Sherd Thickness Dating (MSTD) results are presented in tabular (Tables B.3 to B.24) form for each site encountered during the CRRP that had an assemblage of San Francisco Mountain Gray Ware. Mean Sherd Thicknesses for Site 030702000152 were provided by Neil Weintraub, while those for Site 030701000889 and NA862 are derived from Sorrell (2005:201-204, 221-224). Very low counts of Floyd/Deadmans Gray sherds at sites 03070102782 and 03070102788 prevented surveyors from achieving the minimum sample size stipulated by Sorrell (2005:104-105); meaning the confidence intervals for these sites do not match those that achieved the desired sample size.

A Comparison of Ceramic Cross Dating and Mean Sherd Thickness Dating

Because MSTD has only provisional status as an accepted dating method in the Southwestern archaeology and because this thesis relies so heavily on the dates produced by MSTD, I compared the results of ceramic cross dating which is a well accepted and robust method of dating sites to that of MSTD. The results indicate there is strong correspondence between the two dating methods. This indicates Mean Sherd Thickness Dating is a viable chronometric technique which stands to free Cohonina archaeologists from their reliance on intrusive Kayenta Anasazi wares for chronometric data.

Table B.1. Ceramic types, their production ranges and appropriate references.

WARE	TYPE	PHASE IN	PHASE OUT	REFERENCES
San Francisco Mtn. Gray	Floyd Gray	A.D. 825	A.D. 1025	This Thesis; Mills et al. 1993:62-66
San Francisco Mtn. Gray	Floyd Gray Fugitive Red	A.D. 825	A.D. 1025	This Thesis; Mills et al. 1993:62-66
San Francisco Mtn. Gray	Deadmans Gray	A.D. 800	A.D. 1200	This Thesis; Mills et al. 1993:62-66
San Francisco Mtn. Gray	Deadmans Fugitive Red	A.D. 800	A.D. 1200	This Thesis; Mills et al. 1993:62-66
San Francisco Mtn. Gray	Floyd/Deadmans Gray	-	-	This Thesis; Mills et al. 1993:62-66
San Francisco Mtn. Gray	Floyd/Deadmans Gray Fugitive Red	-	-	This Thesis; Mills et al. 1993:62-66
San Francisco Mtn. Gray	Floyd Black-on-Gray	A.D. 800	A.D. 1025	Mills et al. 1993:62-66; Sorrell 2005; Schubert 2008
San Francisco Mtn. Gray	Deadmans Black-on-Gray	A.D. 800	A.D. 1200	Mills et al. 1993:62-66; Sorrell 2005; Schubert 2008
Tusayan Gray	Lino Gray	A.D. 550	A.D. 825	Mills et al. 1993; Downum 2003; Schubert 2008
Tusayan Gray	Kana-A Gray	A.D. 825	A.D. 1025	Mills et al. 1993; Downum 2003; Schubert 2008
Tusayan Gray	Coconino Gray	A.D. 1025	A.D. 1075	Mills et al. 1993; Downum 2003; Schubert 2008
Tusayan Gray	Clapboard Corrugated	A.D. 1030?	A.D. 1300	Hays-Gilpin and van Hartesveldt 1998:120-135
Tusayan Gray	Indented Corrugated (Tusayan)	A.D. 1050	A.D. 1275	Mills et al. 1993; Downum 2003; Schubert 2008
Tusayan Gray	Moenkopi Corrugated	A.D. 1125	A.D. 1275	Mills et al. 1993; Downum 2003; Schubert 2008
Prescott Gray	Verde Gray	A.D. 1025	A.D. 1200	Mills et al. 1993:67-69
Tusayan White	Lino Black-on-Gray	A.D. 550	A.D. 800	Mills et al. 1993; Downum 2003; Schubert 2008
Tusayan White	Kana-A	A.D. 800	A.D. 1025	Mills et al. 1993; Downum 2003; Schubert 2008
Tusayan White	Black Mesa Black-on-White	A.D. 1025	A.D. 1150	Mills et al. 1993; Downum 2003; Schubert 2008
Tusayan White	Sosi Black-on-White	A.D. 1050	A.D. 1200	Mills et al. 1993; Downum 2003; Schubert 2008
Tusayan White	Dogoszhi Black-on-White	A.D. 1075	A.D. 1150	Mills et al. 1993; Downum 2003; Schubert 2008
Tusayan White	Flagstaff Black-on-White	A.D. 1150	A.D. 1225	Mills et al. 1993; Downum 2003; Schubert 2008
Tusayan White	Shato Black-on-White	A.D. 1025	A.D. 1225	Mills et al. 1993; Downum 2003; Schubert 2008
San Juan Red	Abajo Polychrome	A.D. 700	A.D. 850	Mills et al. 1993:73
San Juan Red	Abajo Red-on-Orange	A.D. 725	A.D. 880	Ortman et al. 2005:19-21
San Juan Red	Deadmans Black-on-Red	A.D. 750	A.D. 1075	Mills et al. 1993; Downum 2003; Schubert 2008
Tsegi Orange	Medicine Black-on-Red	A.D. 1065	A.D. 1125	Mills et al. 1993; Downum 2003; Schubert 2008
Tsegi Orange	Tusayan Black-on-Red	A.D. 1065	A.D. 1200	Mills et al. 1993; Downum 2003; Schubert 2008
Tsegi Orange	Citadel Polychrome	A.D. 1125	A.D. 1200	Mills et al. 1993; Downum 2003; Schubert 2008
Alameda Brown	Rio de Flag Brown	A.D. 650	A.D. 1080	Mills et al. 1993:78-80; Elson 2011
Alameda Brown	Winona Brown	A.D. 1080	A.D. 1300	Mills et al. 1993:78-80; Elson 2011

I hypothesized that Ceramic Cross Dating and Mean Sherd Thickness Dating produce similar results. In this case the null hypothesis is the two dating methods produce completely different results. Figure B.1 and Table B.2 compare the relationship of mean dates derived from the Quadratic and Linear models of MSTD for sites encountered during the CRRP against the midpoint of the date range derived from ceramic cross dating. Figure B.1 indicates there is a positive correlation between the date estimates. In order to test the statistical significance of that correlation I chose a .05 level of significance using the correlation coefficient (r). In this case the critical value for a directional test with (n-2) 19 degrees of freedom at $\alpha = .05$ is .3687 (Thomas 1986, Table A:11). The r value for the quadratic model of MSTD and CCD comparison is .6360, while that of the linear model MSTD and CCD comparison is .6465. Both r values reject the null hypothesis. This means temporal assignments derived from Mean Sherd Thickness Dating and Ceramic Cross Dating strongly agree with each other. These results justify the use of MSTD in surface survey contexts, meaning Cohonina archaeologists no longer have to rely on intrusive Kayenta wares to date their sites.

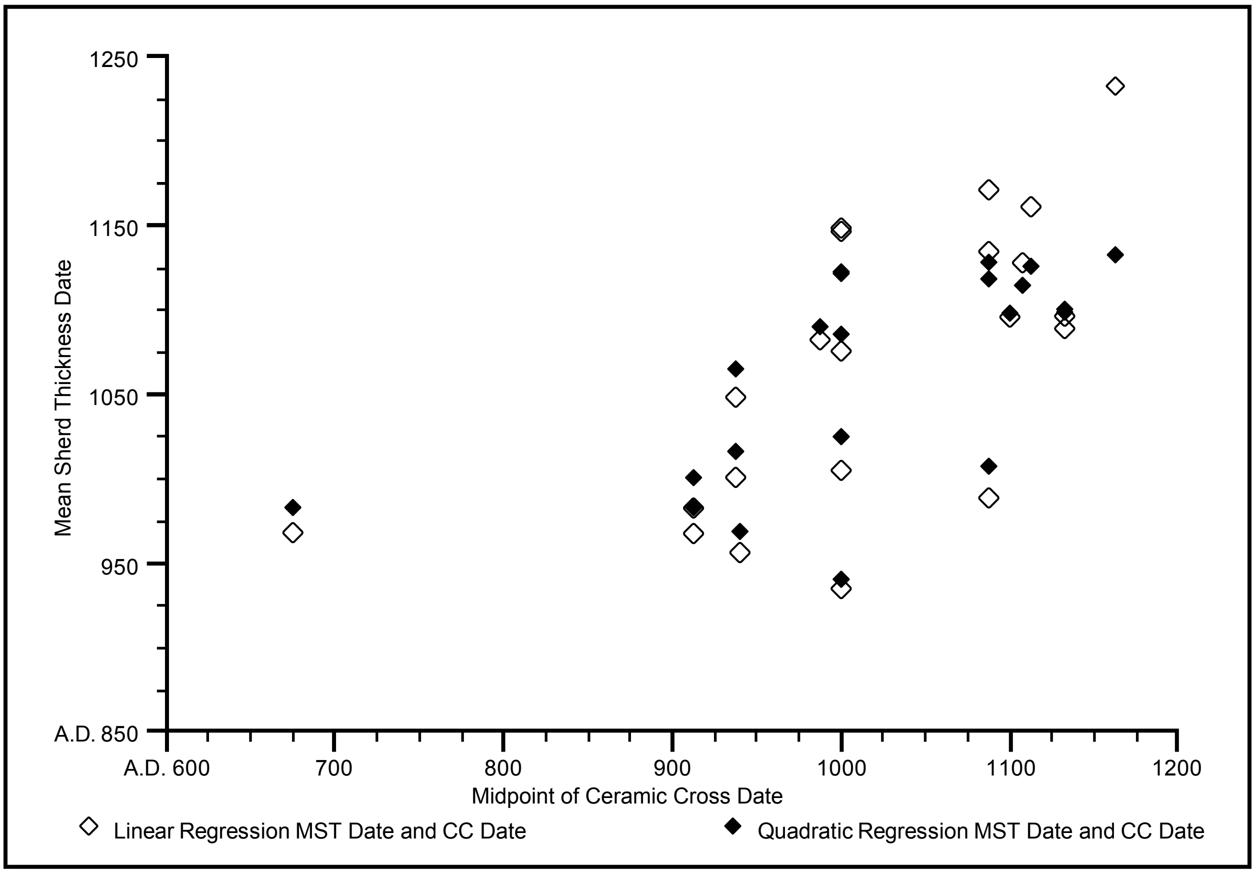


Figure B.1. Comparison of ceramic cross dating and mean sherd thickness dating.

This includes the set of sites within the Pittsberg settlment system. Note the strong positive relationship bewtween the two chronological methods, regardless of which mean sherd thickness dating equation is used. Also, note the single extreme outlier which is Site 02782.

Table B.2. Comparison of ceramic cross dates and mean sherd thickness dates.

SITE	CCD early	CCD mid	CCD late	MSTD Quadratic low	MSTD Quadratic mean	MSTD Quadratic high	MSTD Linear low	MSTD Linear mean	MSTD Linear high
00238	A.D. 800	A.D. 1000	A.D. 1200	A.D. 904	A.D. 946	A.D. 988	A.D. 894	A.D. 940	A.D. 986
00889	A.D. 1050	A.D. 1100	A.D. 1150	A.D. 1071	A.D. 1113	A.D. 1155	A.D. 1065	A.D. 1111	A.D. 1157
01468	A.D. 1065	A.D. 1133	A.D. 1200	A.D. 1073	A.D. 1115	A.D. 1157	A.D. 1057	A.D. 1103	A.D. 1149
02433	A.D. 800	A.D. 940	A.D. 1080	A.D. 919	A.D. 961	A.D. 1003	A.D. 905	A.D. 951	A.D. 997
02774	A.D. 1065	A.D. 1133	A.D. 1200	A.D. 1072	A.D. 1114	A.D. 1156	A.D. 1065	A.D. 1111	A.D. 1157
02775	A.D. 1065	A.D. 1108	A.D. 1150	A.D. 1088	A.D. 1130	A.D. 1172	A.D. 1099	A.D. 1145	A.D. 1191
02776	A.D. 1025	A.D. 1088	A.D. 1150	A.D. 1103	A.D. 1145	A.D. 1187	A.D. 1144	A.D. 1190	A.D. 1236
02778	A.D. 800	A.D. 1000	A.D. 1200	A.D. 1058	A.D. 1100	A.D. 1142	A.D. 1043	A.D. 1089	A.D. 1135
02779	A.D. 800	A.D. 938	A.D. 1075	A.D. 1036	A.D. 1078	A.D. 1120	A.D. 1014	A.D. 1060	A.D. 1106
02780	A.D. 825	A.D. 988	A.D. 1150	A.D. 1063	A.D. 1105	A.D. 1147	A.D. 1050	A.D. 1096	A.D. 1142
02782	A.D. 550	A.D. 675	A.D. 800	A.D. 949	A.D. 991	A.D. 1033	A.D. 929	A.D. 975	A.D. 1021
02783	A.D. 800	A.D. 938	A.D. 1075	A.D. 999	A.D. 1041	A.D. 1083	A.D. 974	A.D. 1020	A.D. 1066
02784	A.D. 800	A.D. 913	A.D. 1025	A.D. 949	A.D. 991	A.D. 1033	A.D. 929	A.D. 975	A.D. 1021
02786	A.D. 1025	A.D. 1088	A.D. 1150	A.D. 975	A.D. 1017	A.D. 1059	A.D. 951	A.D. 997	A.D. 1043
02788	A.D. 800	A.D. 1000	A.D. 1200	A.D. 1096	A.D. 1138	A.D. 1180	A.D. 1118	A.D. 1164	A.D. 1210
02792	A.D. 800	A.D. 1000	A.D. 1200	A.D. 1087	A.D. 1139	A.D. 1171	A.D. 1120	A.D. 1166	A.D. 1212
02793	A.D. 1025	A.D. 1088	A.D. 1150	A.D. 1093	A.D. 1135	A.D. 1177	A.D. 1106	A.D. 1152	A.D. 1198
02795	A.D. 800	A.D. 1000	A.D. 1200	A.D. 993	A.D. 1035	A.D. 1077	A.D. 968	A.D. 1014	A.D. 1060
02796	A.D. 1125	A.D. 1163	A.D. 1200	A.D. 1108	A.D. 1150	A.D. 1192	A.D. 1188	A.D. 1234	A.D. 1280
02800	A.D. 1025	A.D. 1113	A.D. 1200	A.D. 1100	A.D. 1142	A.D. 1184	A.D. 1134	A.D. 1180	A.D. 1226
02803	A.D. 800	A.D. 913	A.D. 1025	A.D. 968	A.D. 1010	A.D. 1052	A.D. 945	A.D. 991	A.D. 1037

Chronograms

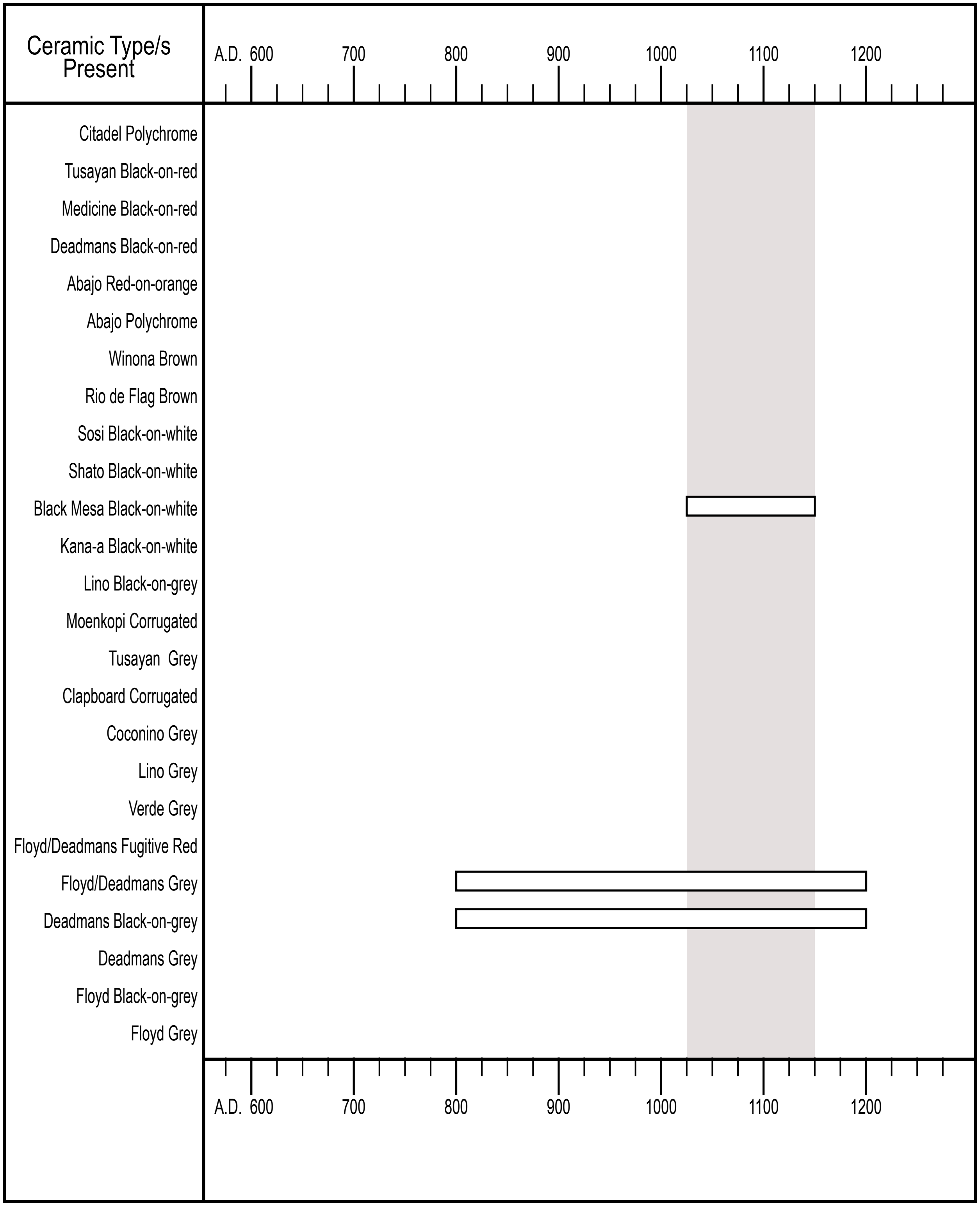


Figure B.2. Site 03070100127 Chronogram.

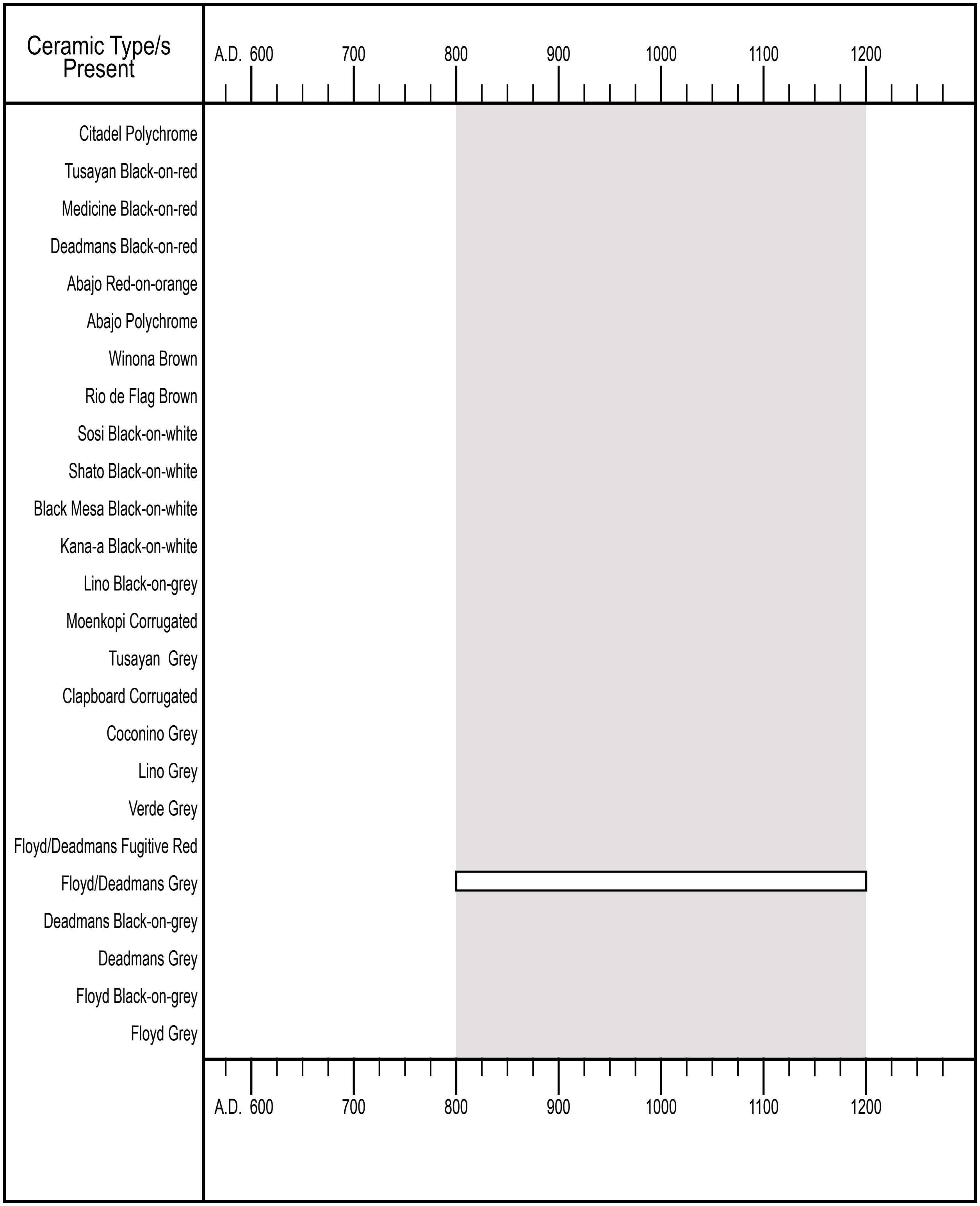


Figure B.3. Site 03070100237 Chronogram.

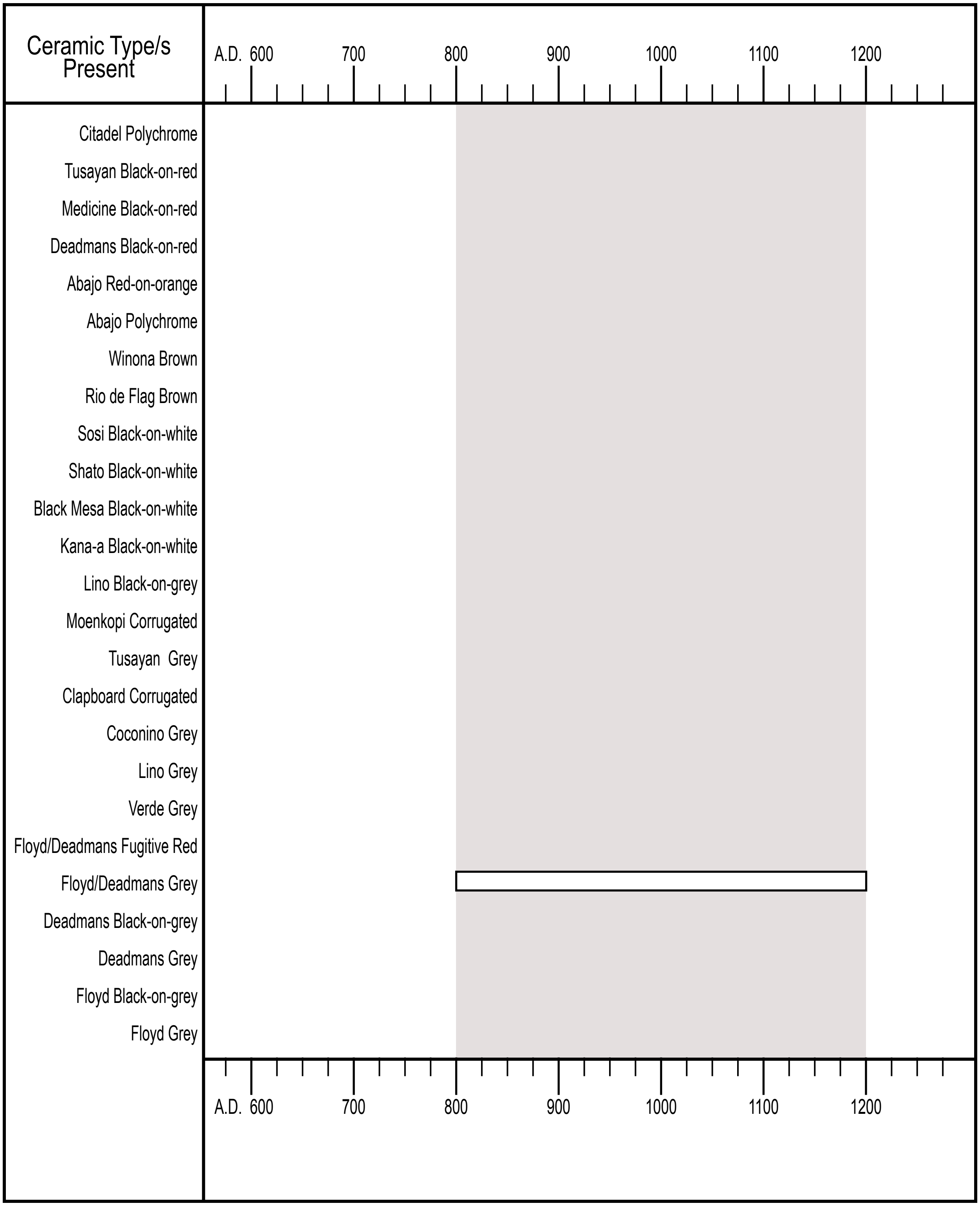


Figure B.4. Site 03070100238 Chronogram.

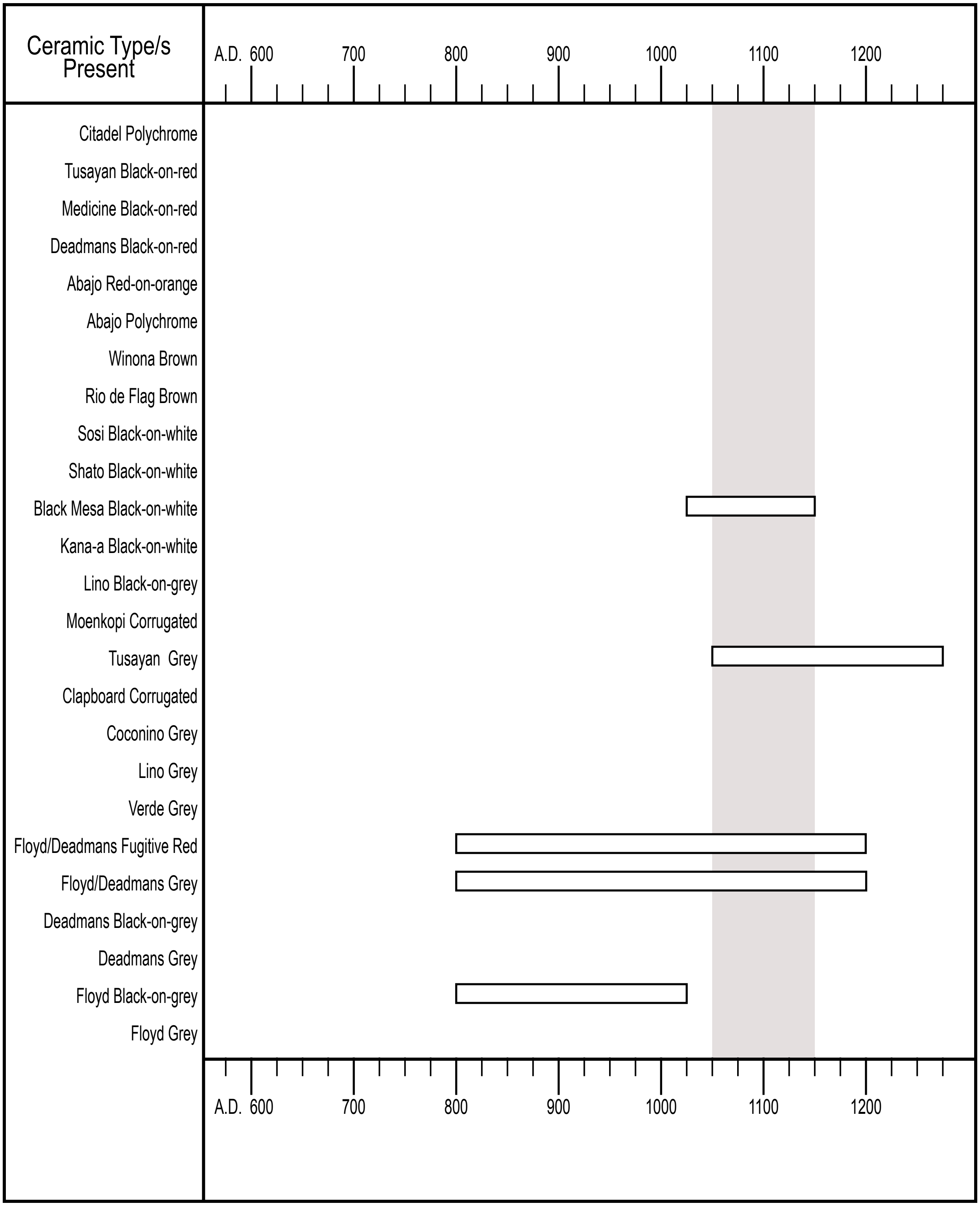


Figure B.5. Site 03070100301 Chronogram.

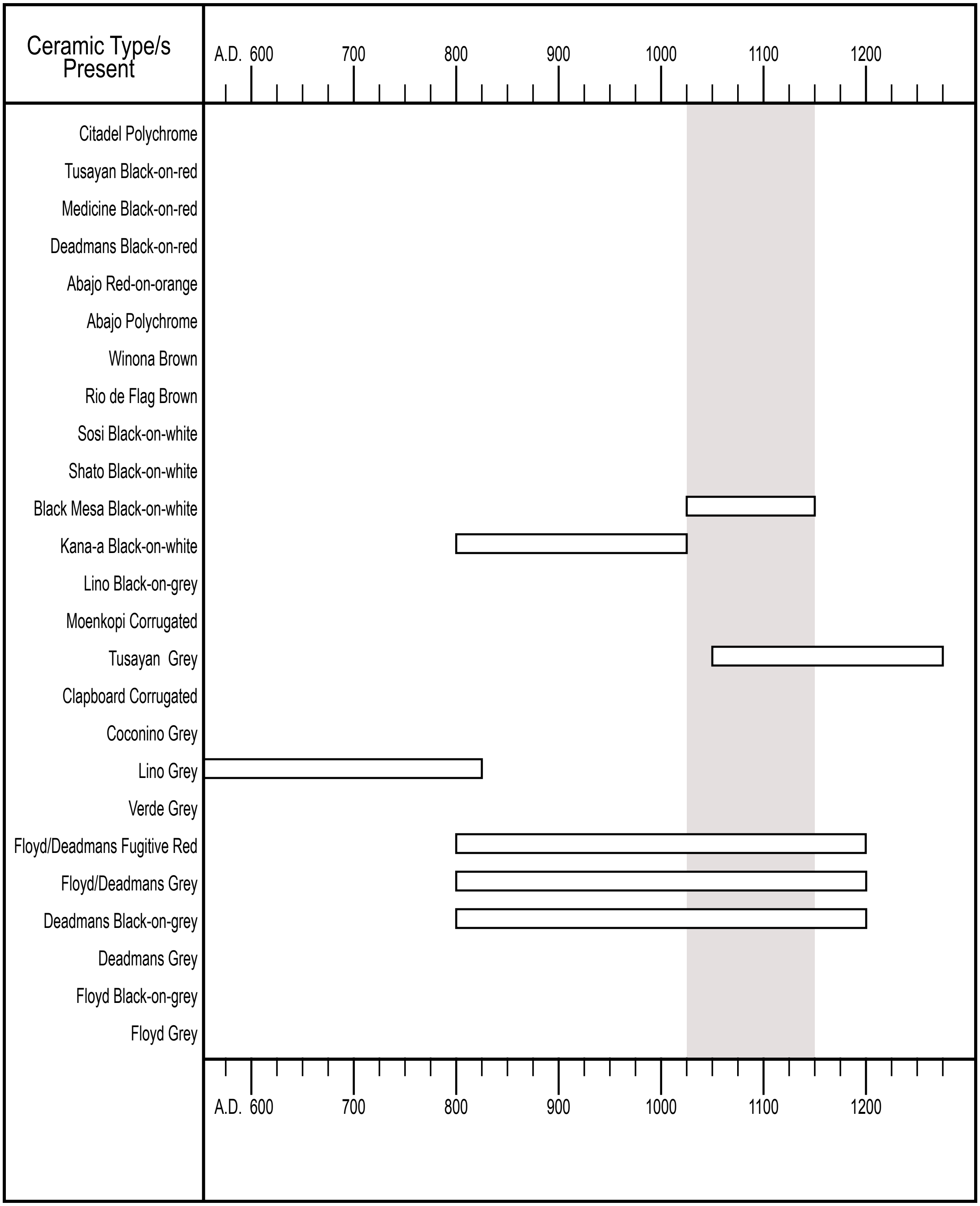


Figure B.6. Site 03070100402 Chronogram.

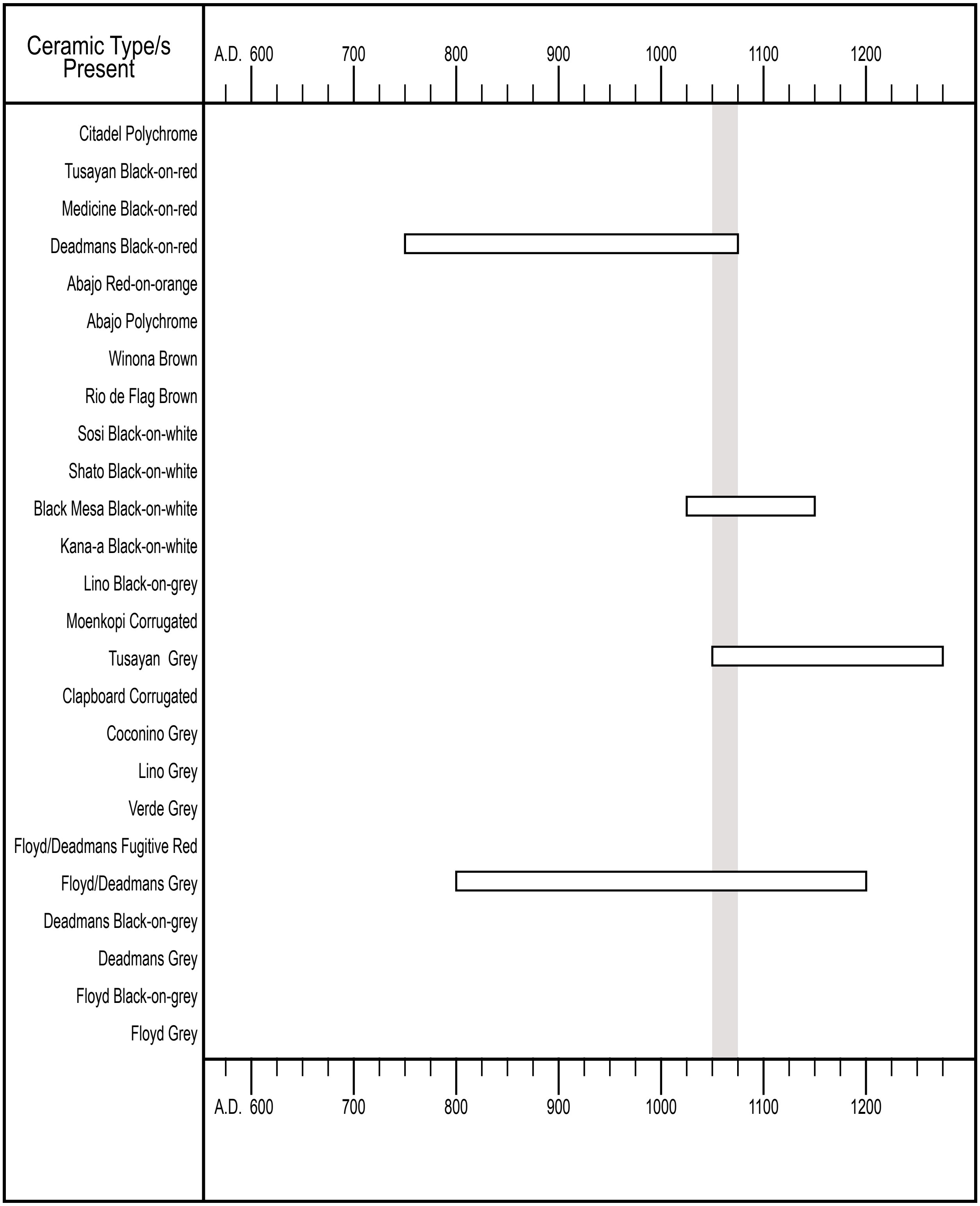


Figure B.7. Site 03070100584 Chronogram.

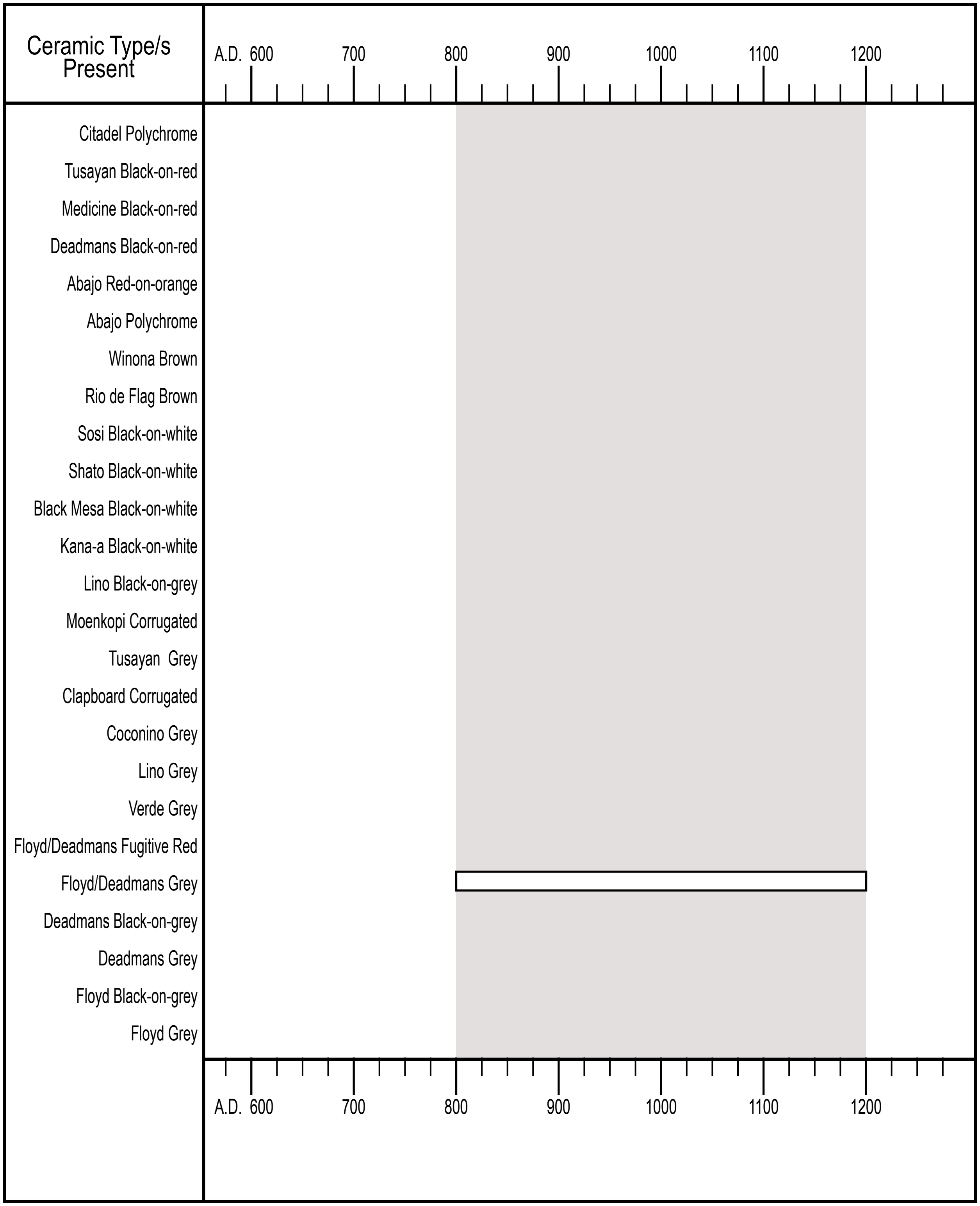


Figure B.8. Site 03070100701 Chronogram.

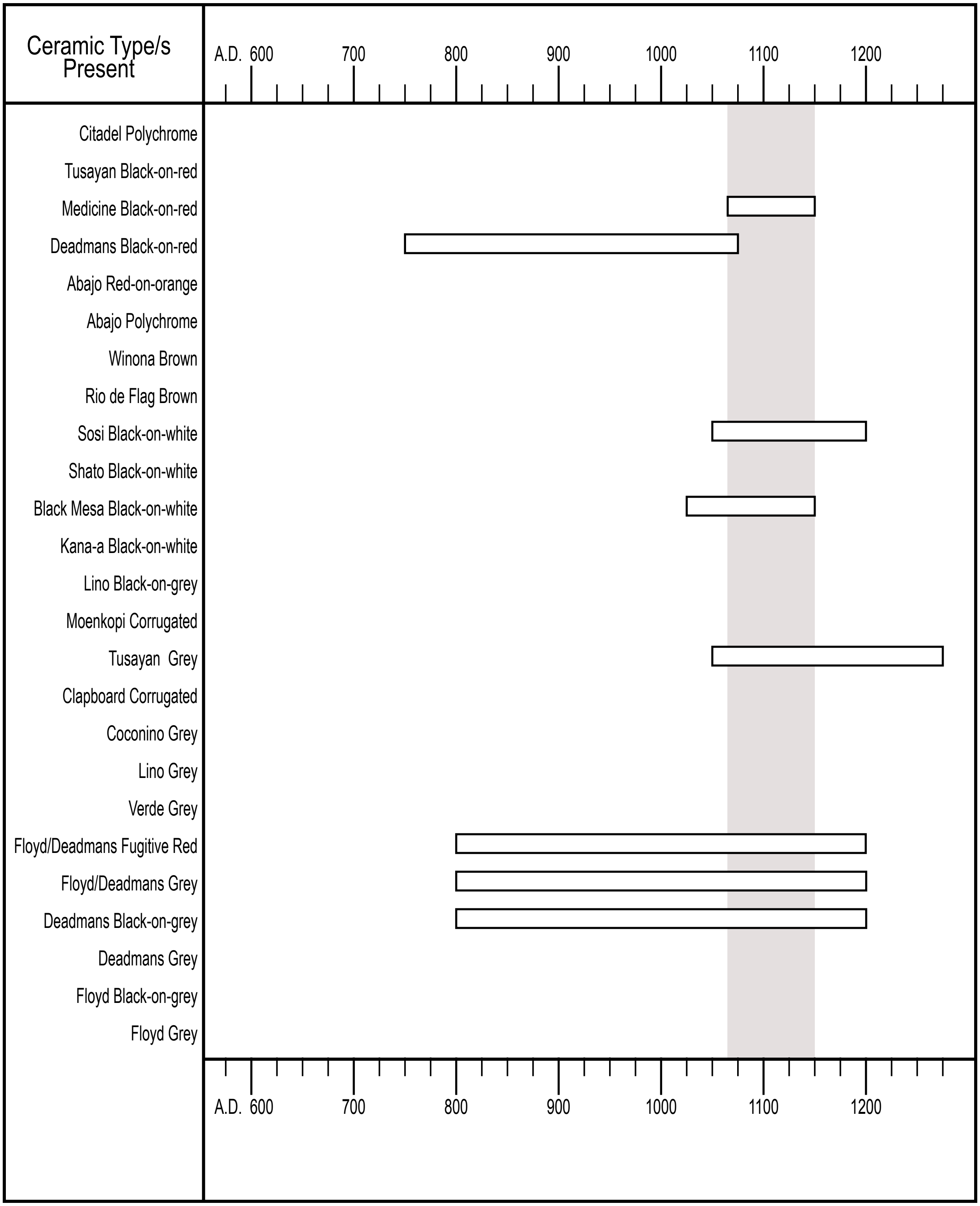


Figure B.9. Site 03070100746 Chronogram.

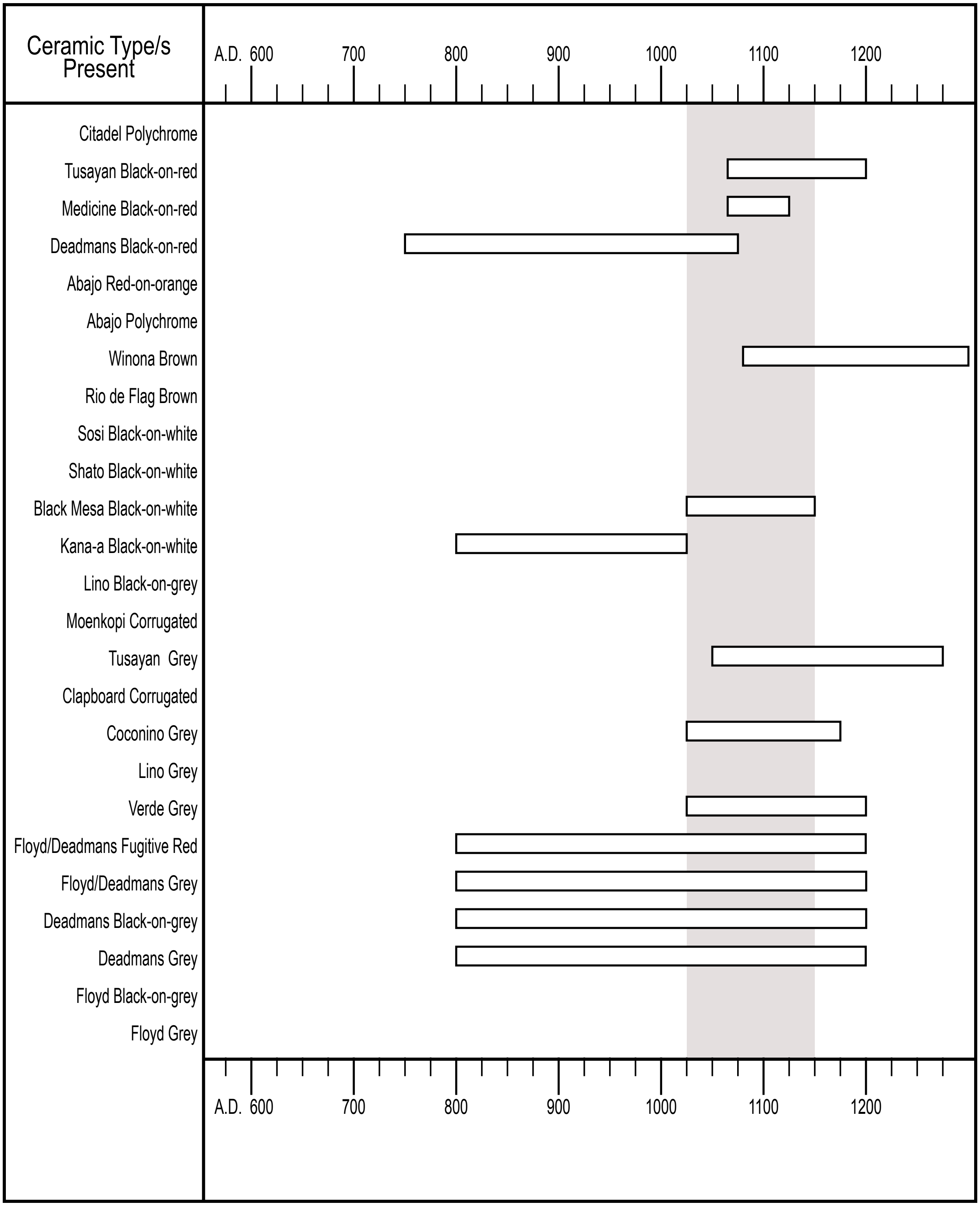


Figure B.10. Site 03070100889 Chronogram.

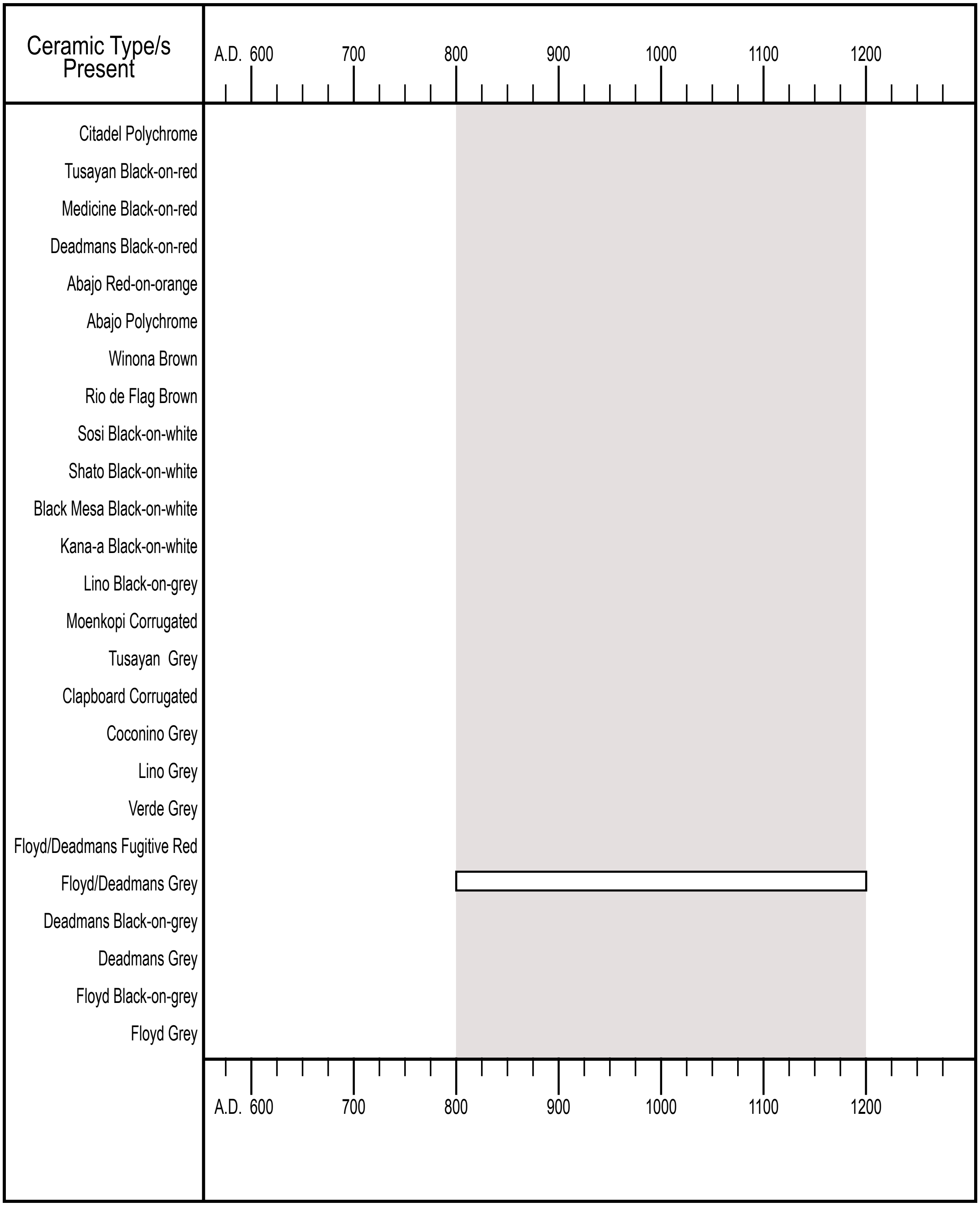


Figure B.11. Site 03070101200 Chronogram.

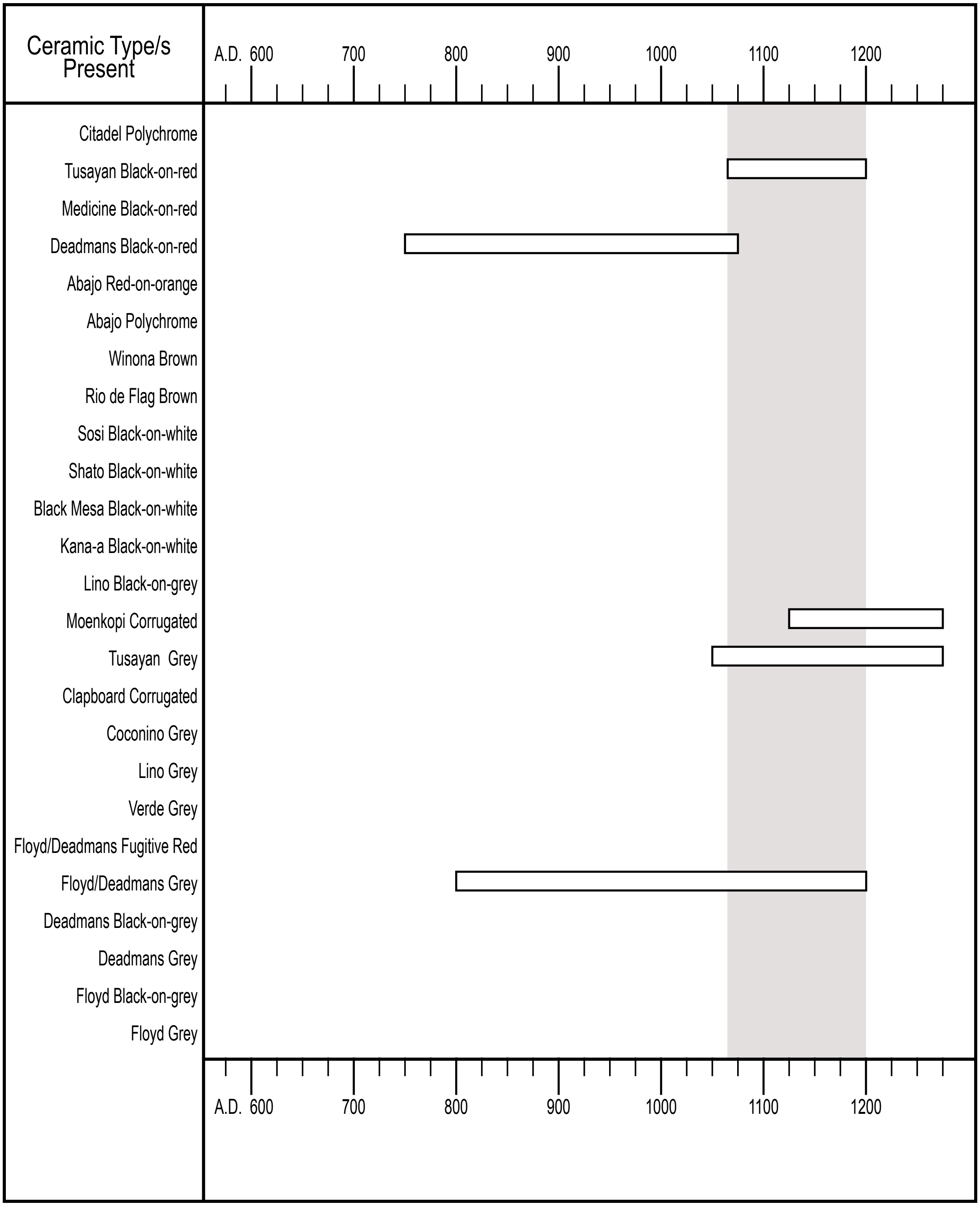


Figure B.12. Site 03070101323 Chronogram.

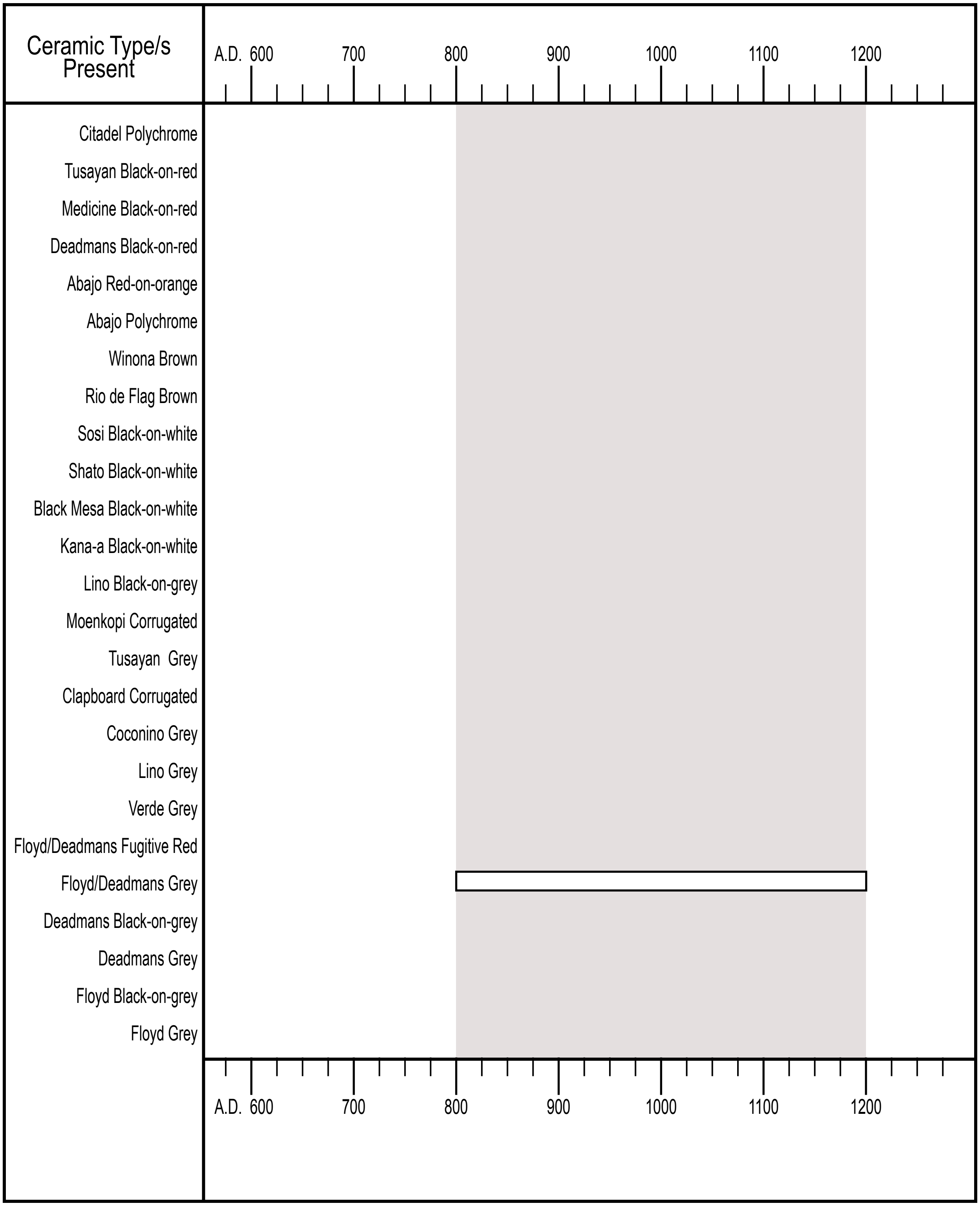


Figure B.13. Site 03070101398 Chronogram.

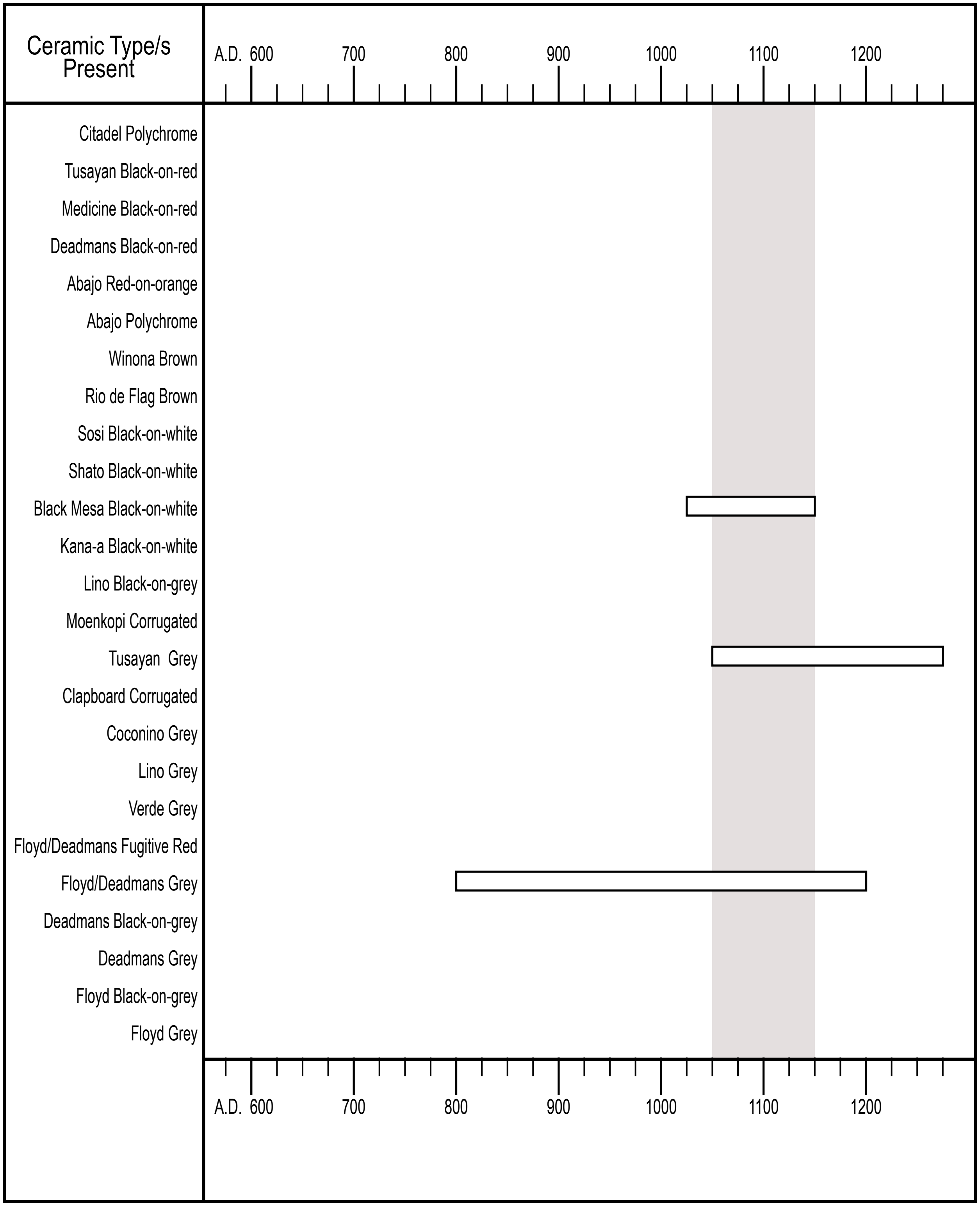


Figure B.14. Site 03070101467 Chronogram.

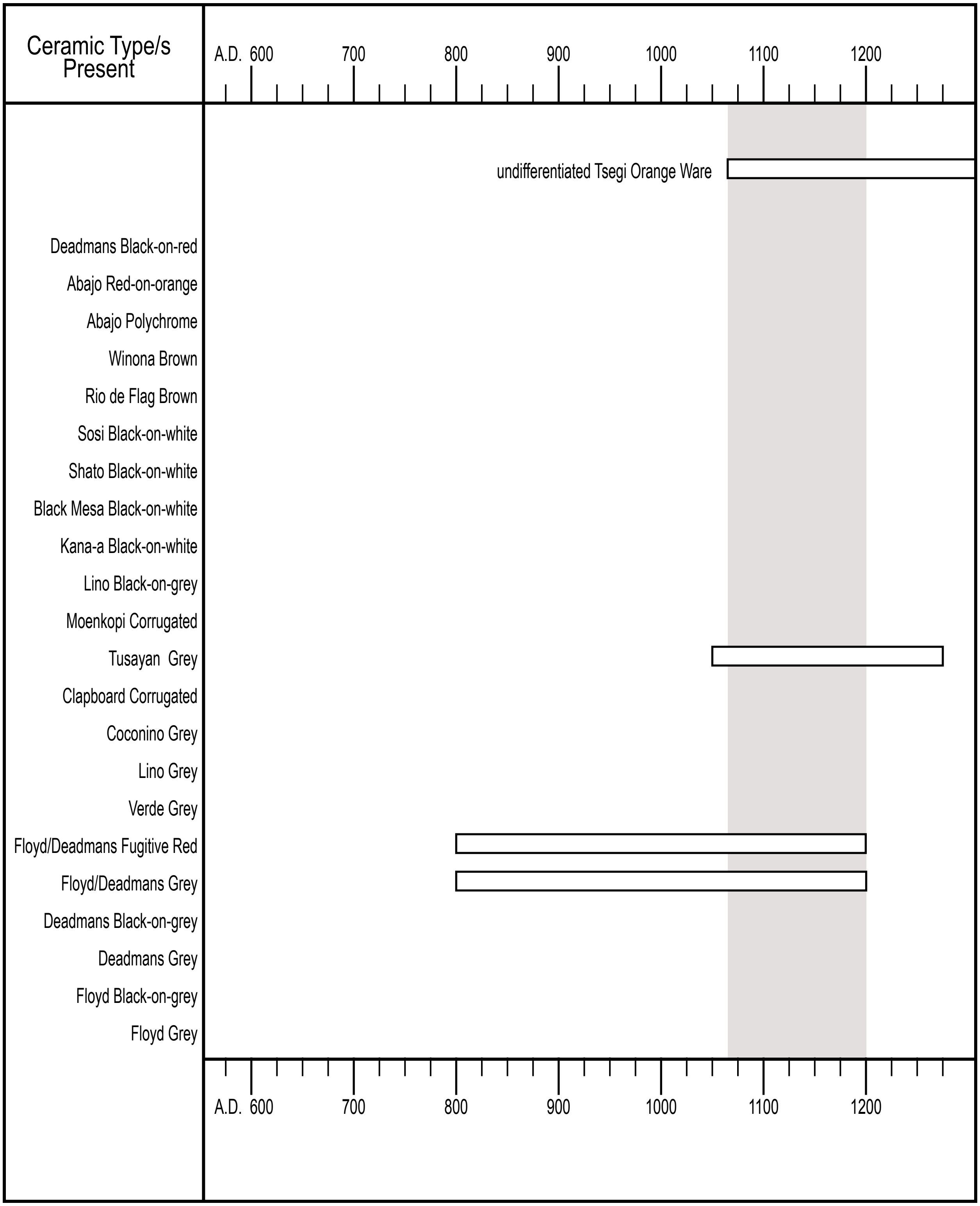


Figure B.15. Site 03070101468 Chronogram.

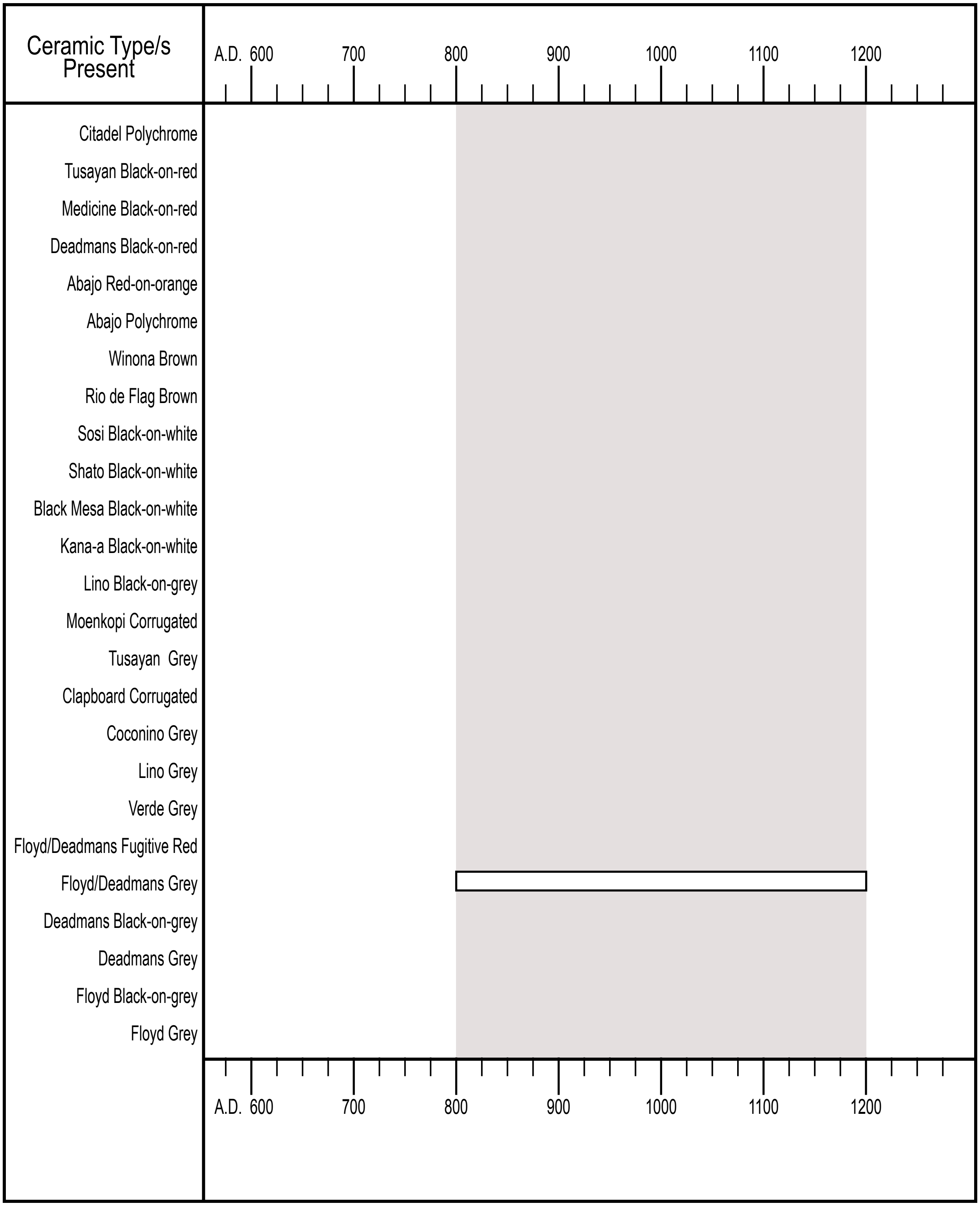


Figure B.16. Site 03070101507 Chronogram.

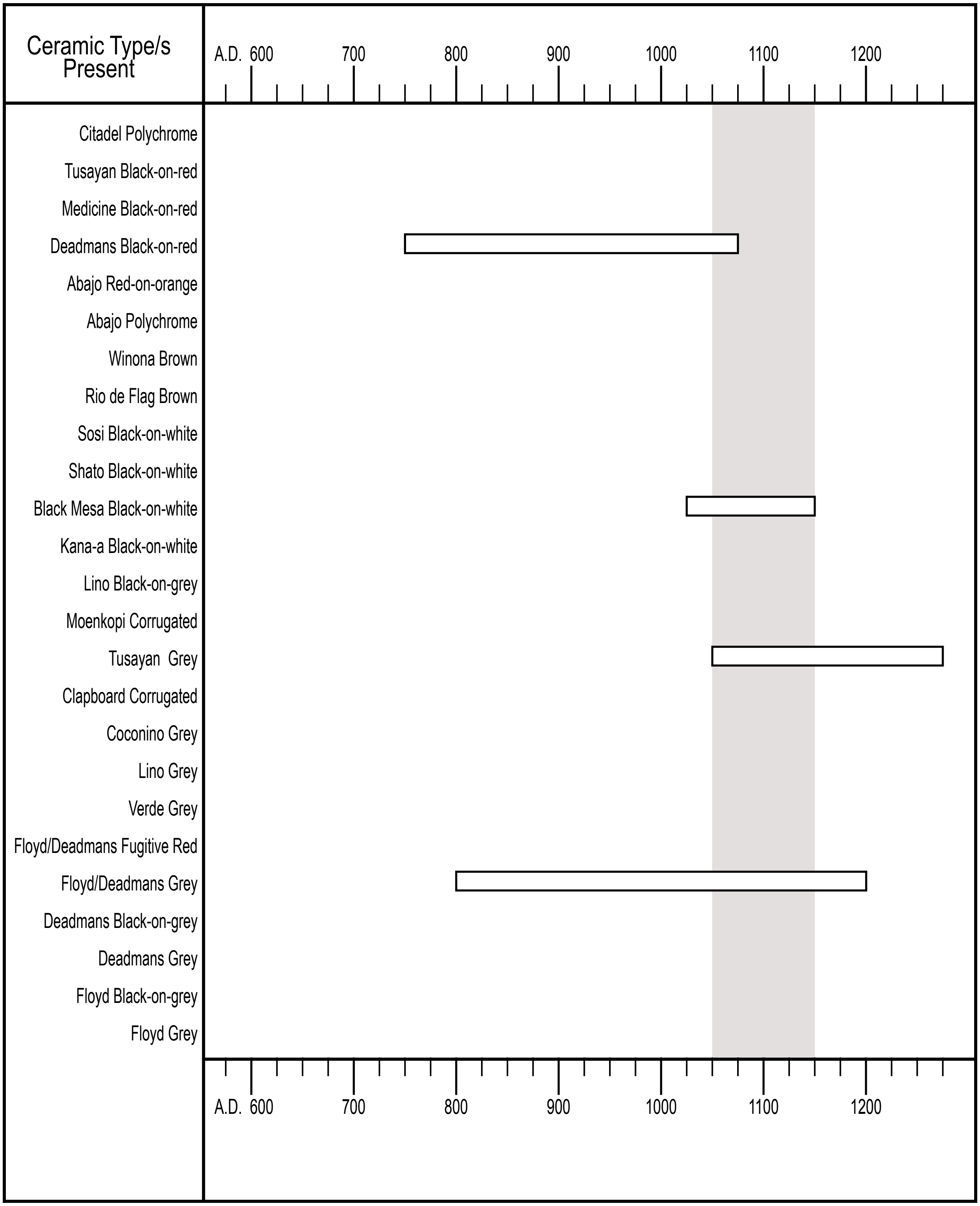


Figure B.17. Site 03070102338 Chronogram.

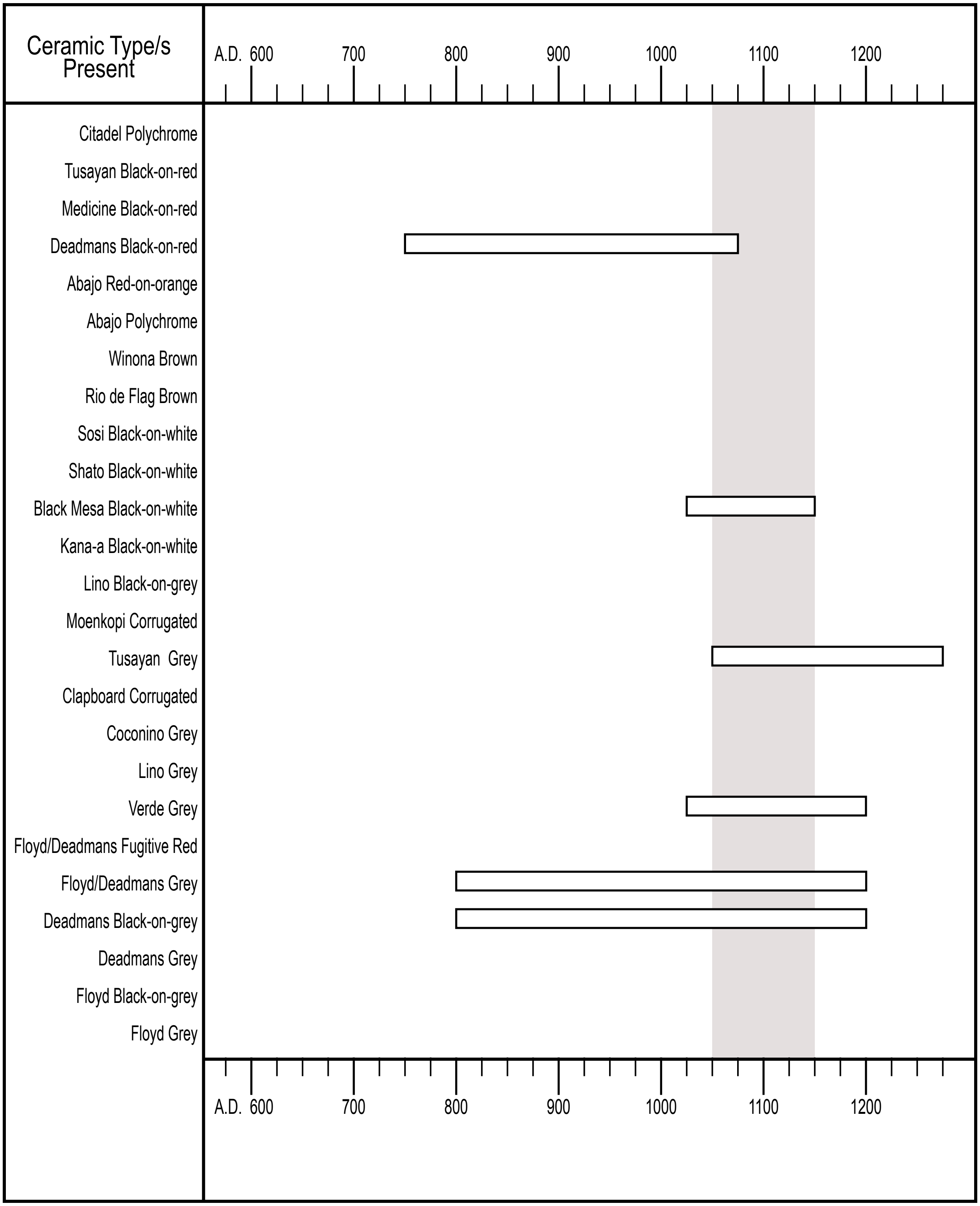


Figure B.18. Site 03070102365 Chronogram.

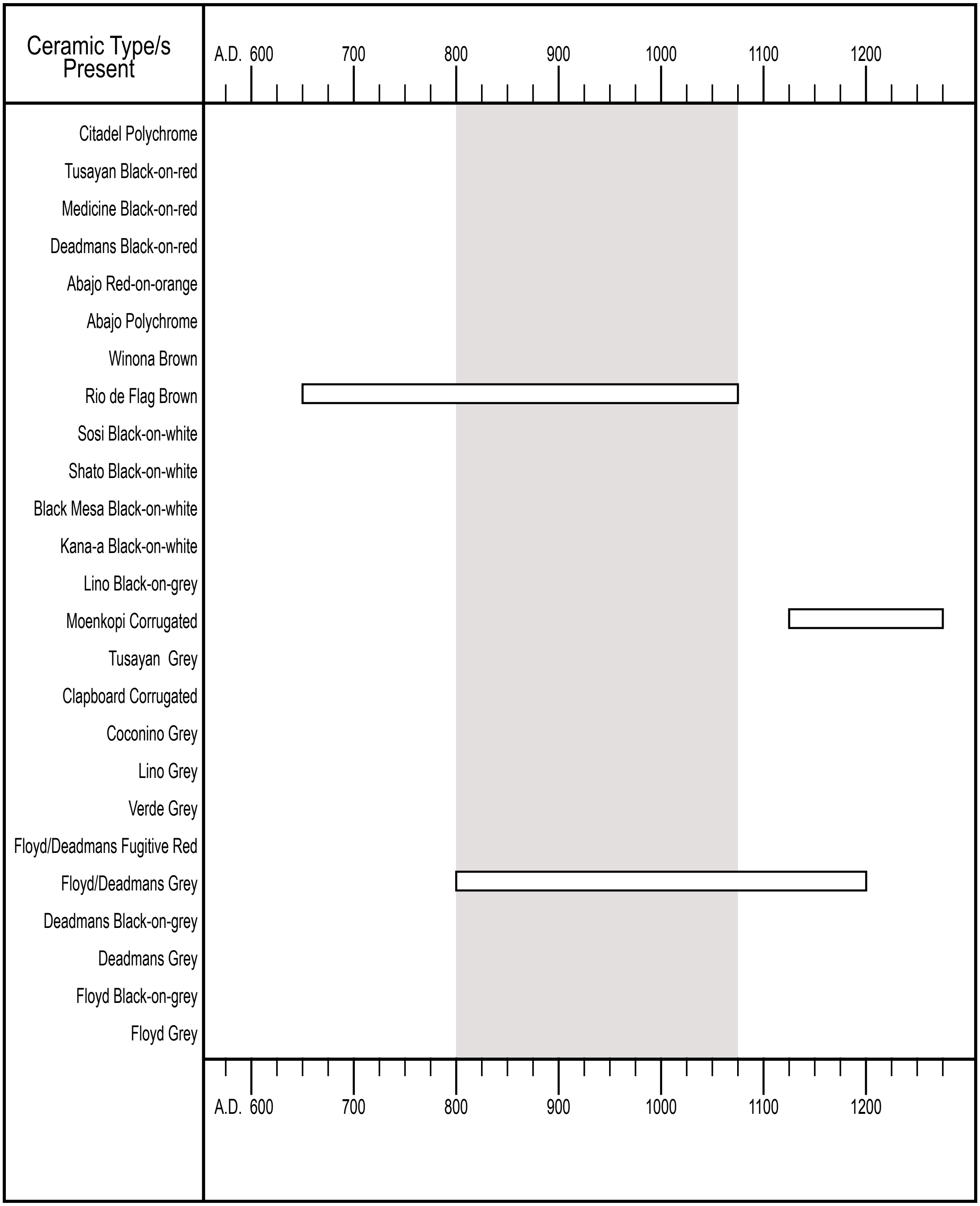


Figure B.19. Site 03070102433 Chronogram.

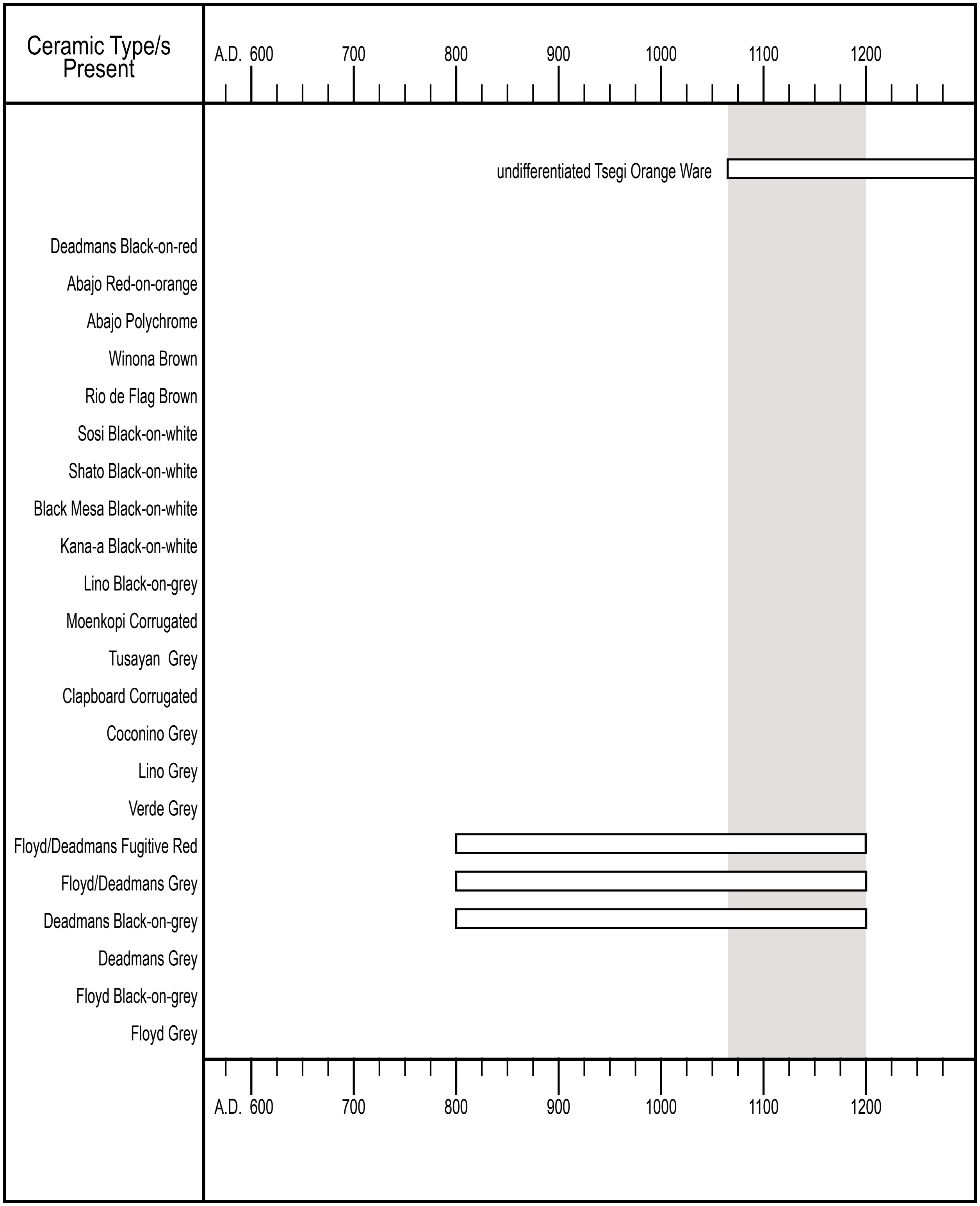


Figure B.20. Site 03070102774 Chronogram.

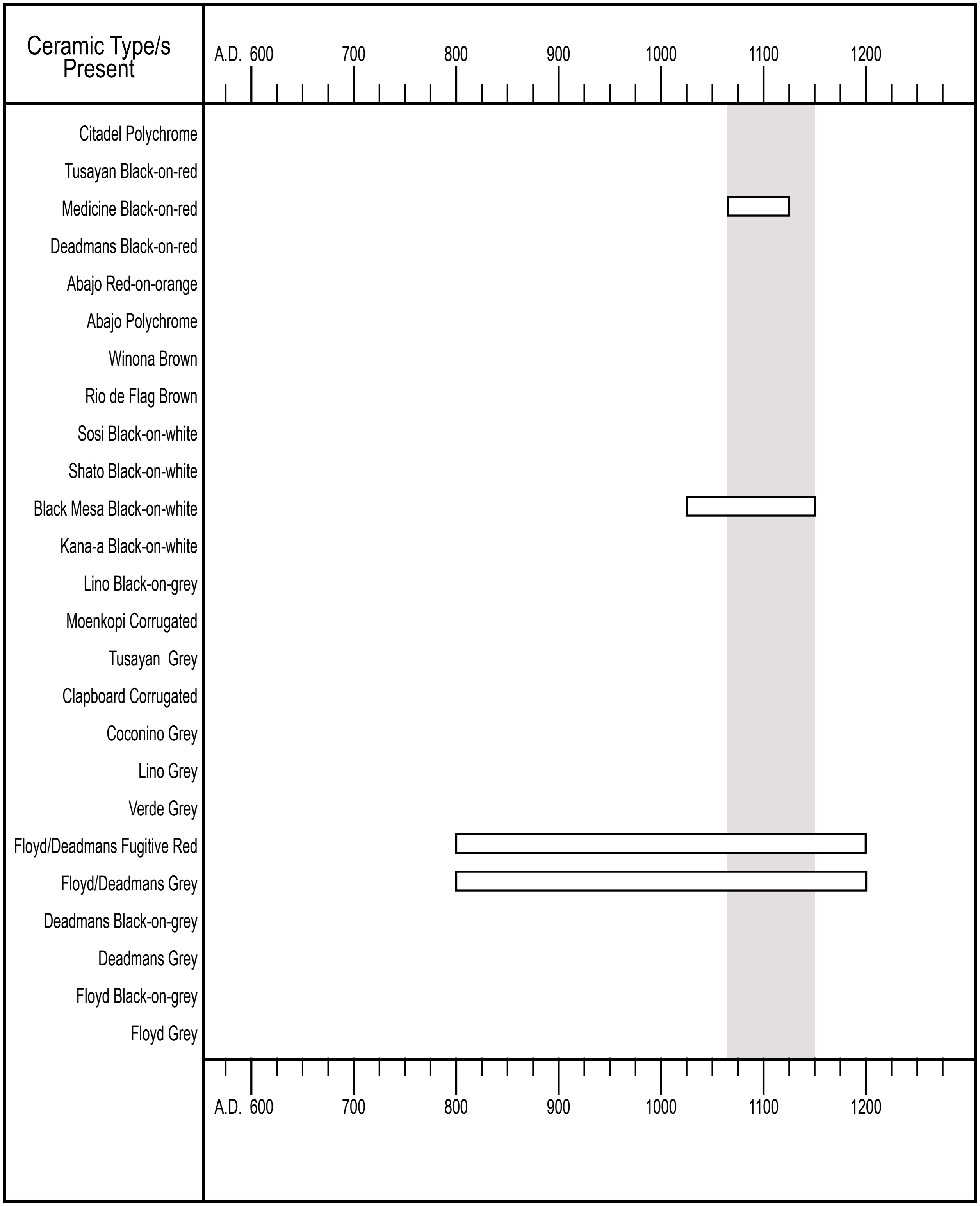


Figure B.21. Site 03070102775 Chronogram.

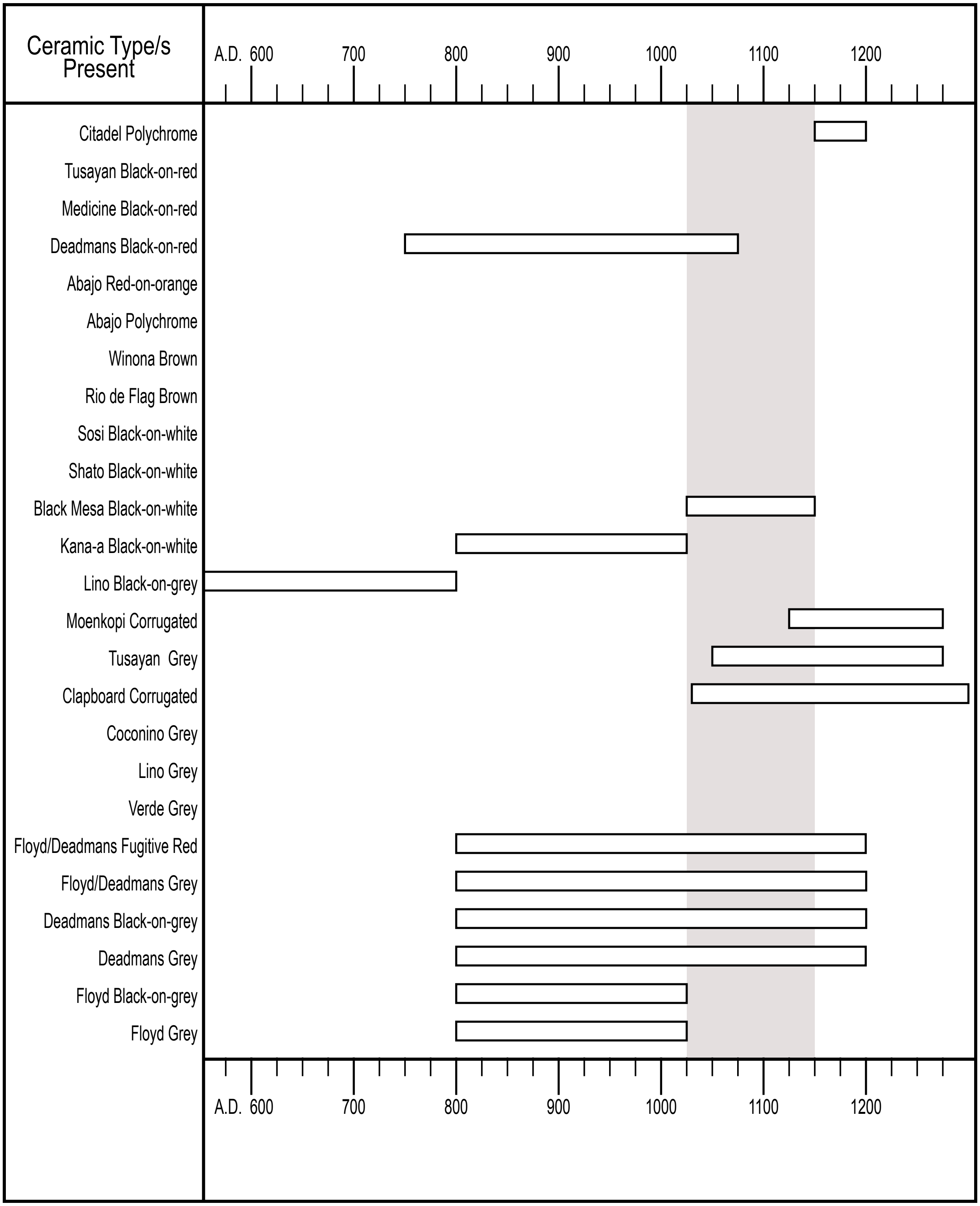


Figure B.22. Site 03070102776 Chronogram.

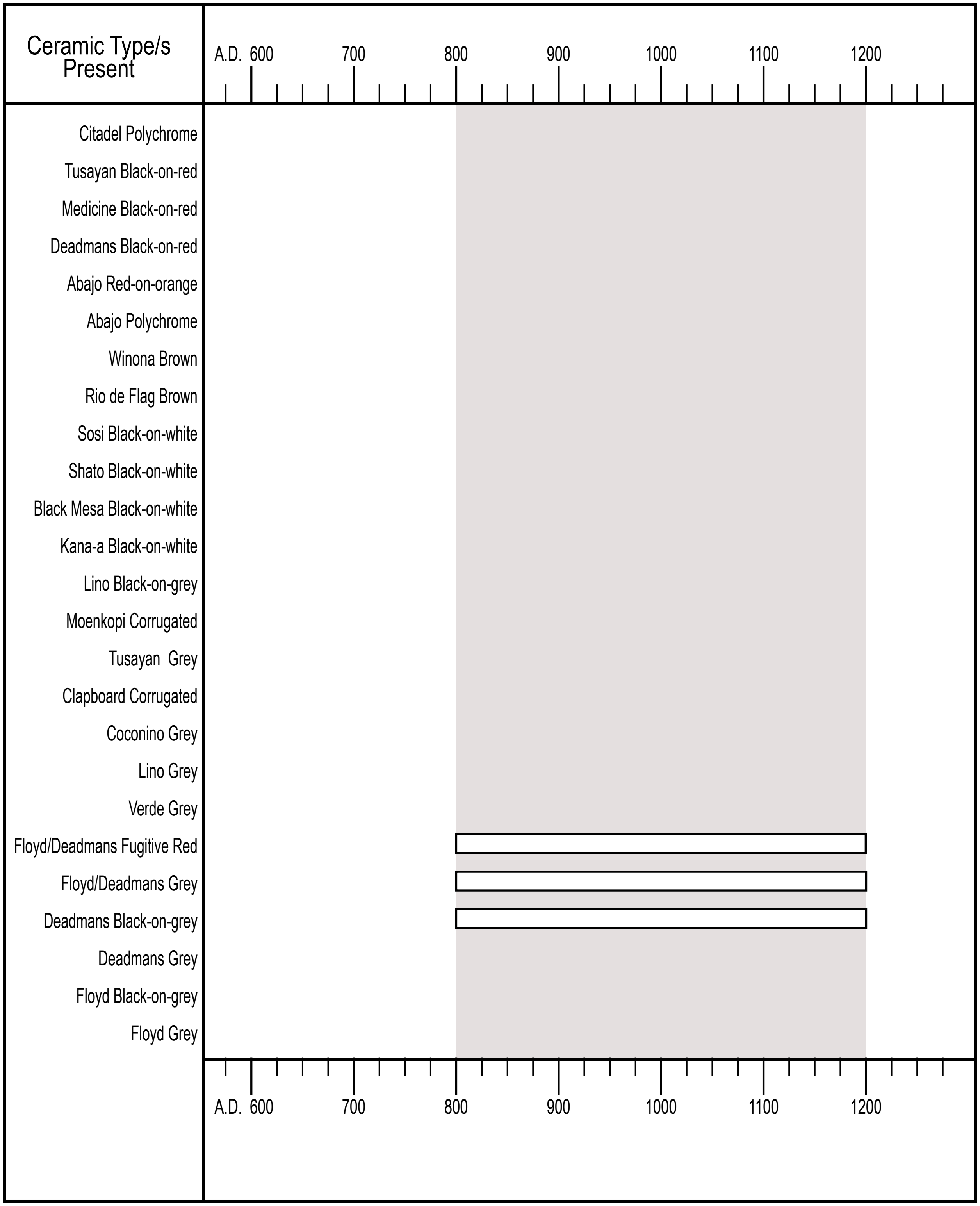


Figure B.23. Site 03070102778 Chronogram.

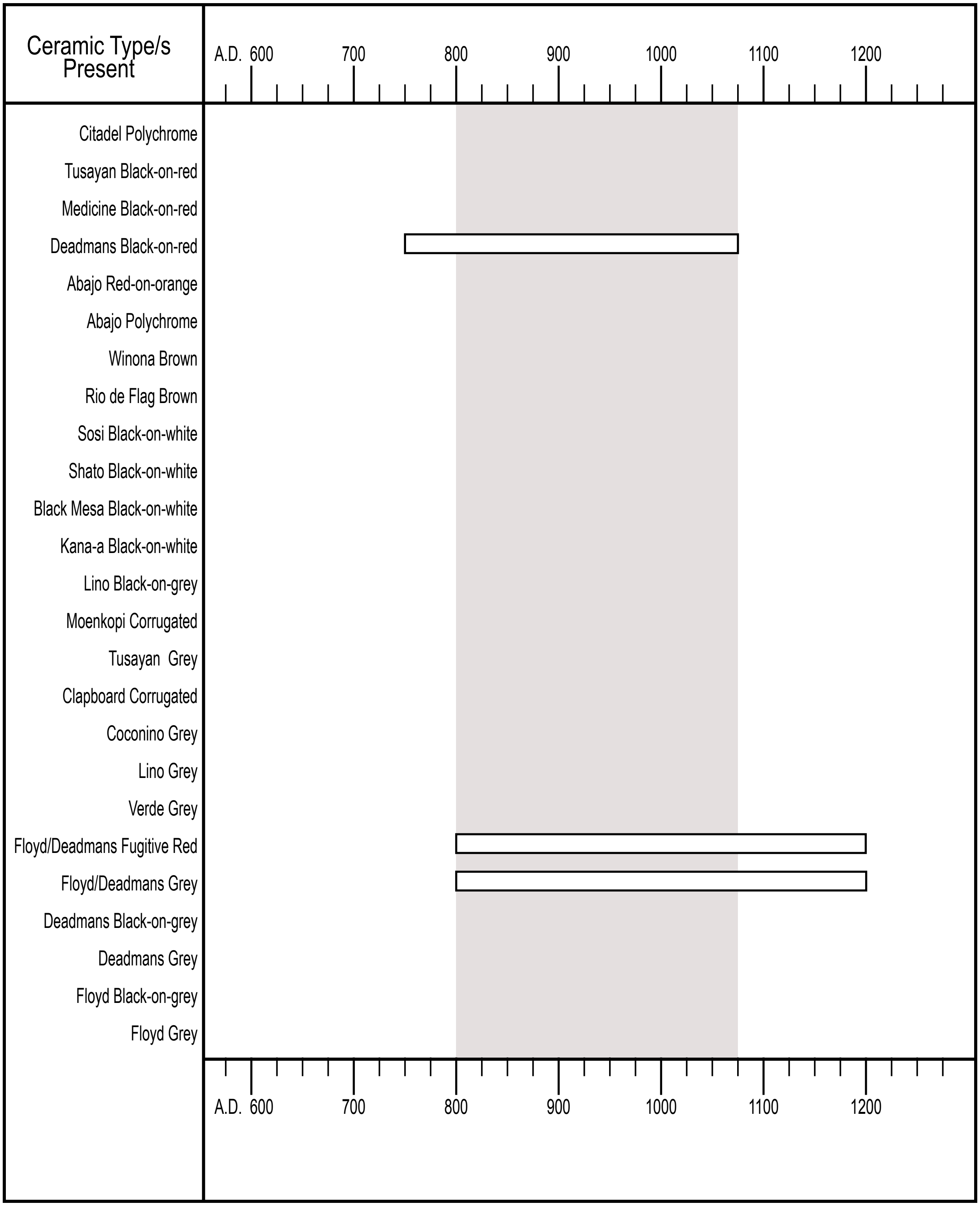


Figure B.24. Site 03070102779 Chronogram.

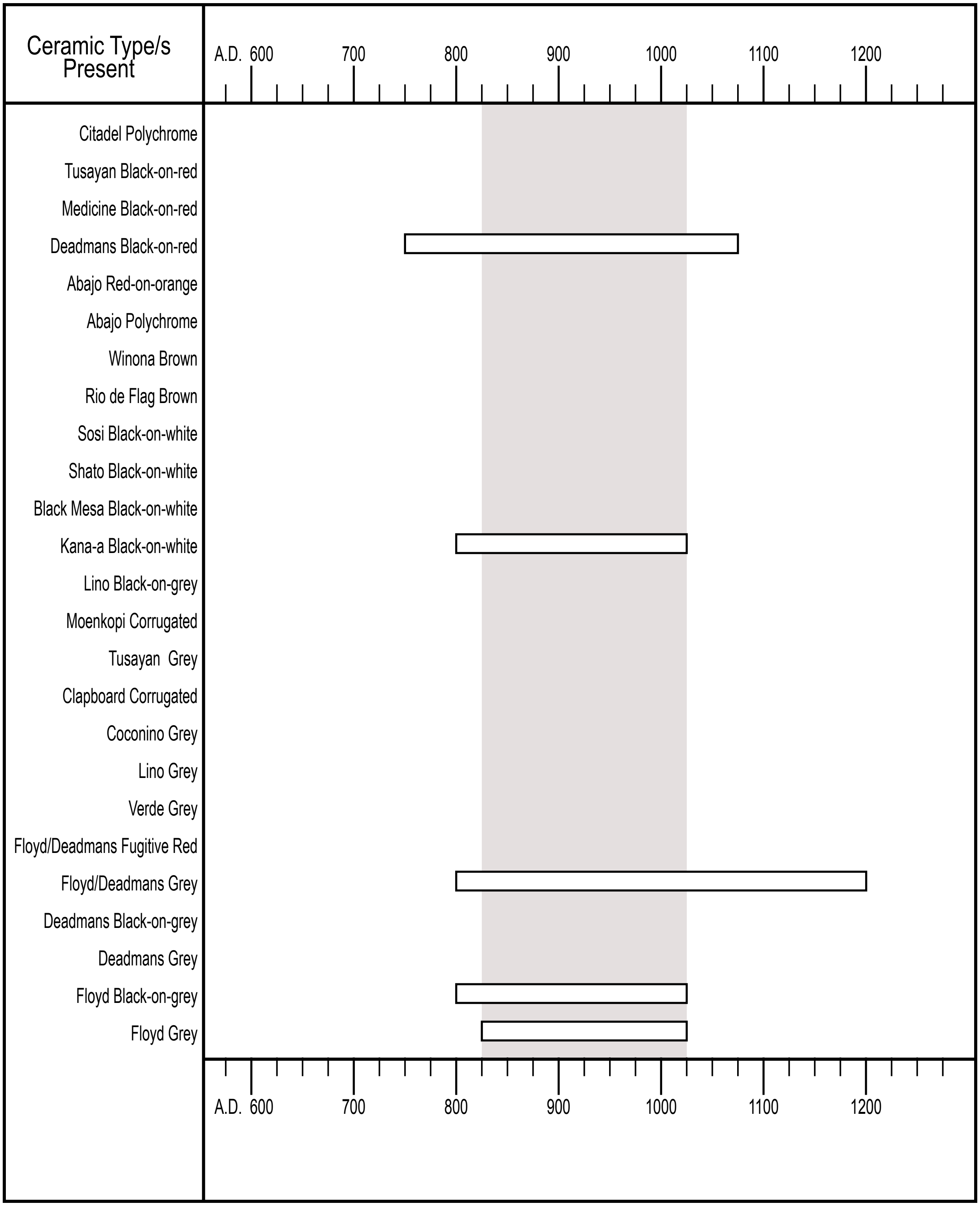


Figure B.25. Site 03070102780 Chronogram.

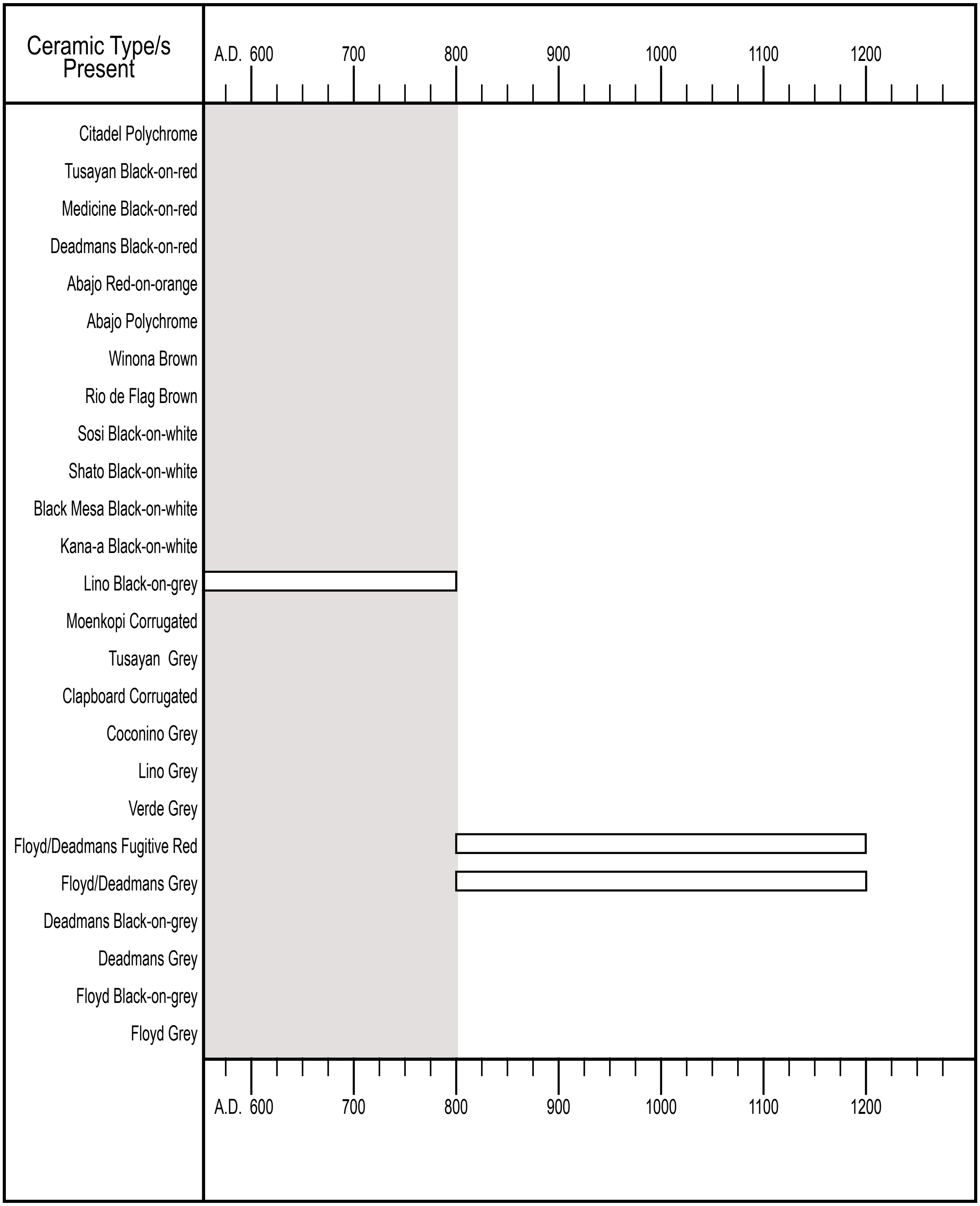


Figure B.26. Site 03070102782 Chronogram.

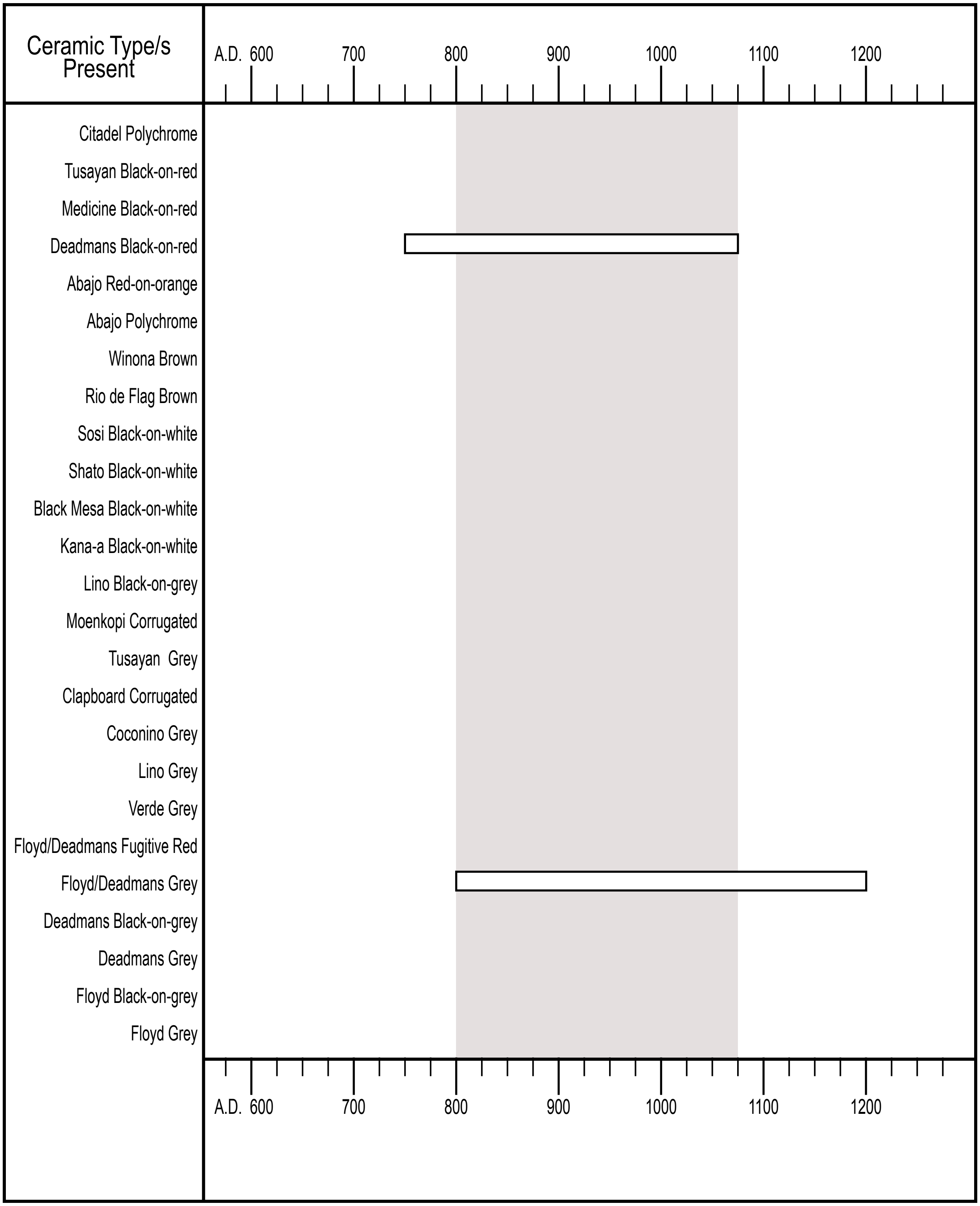


Figure B.27. Site 03070102783 Chronogram.

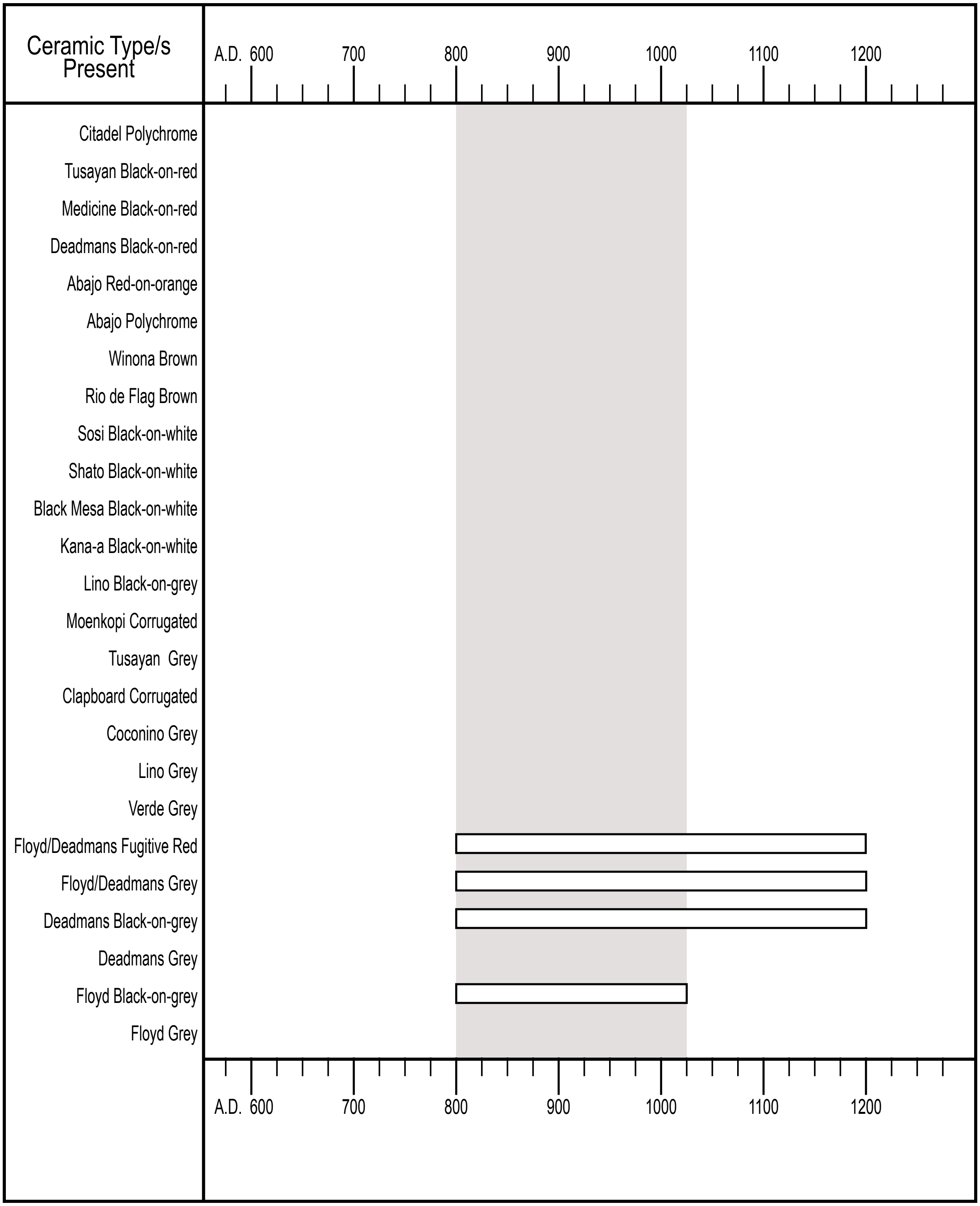


Figure B.28. Site 03070102784 Chronogram.

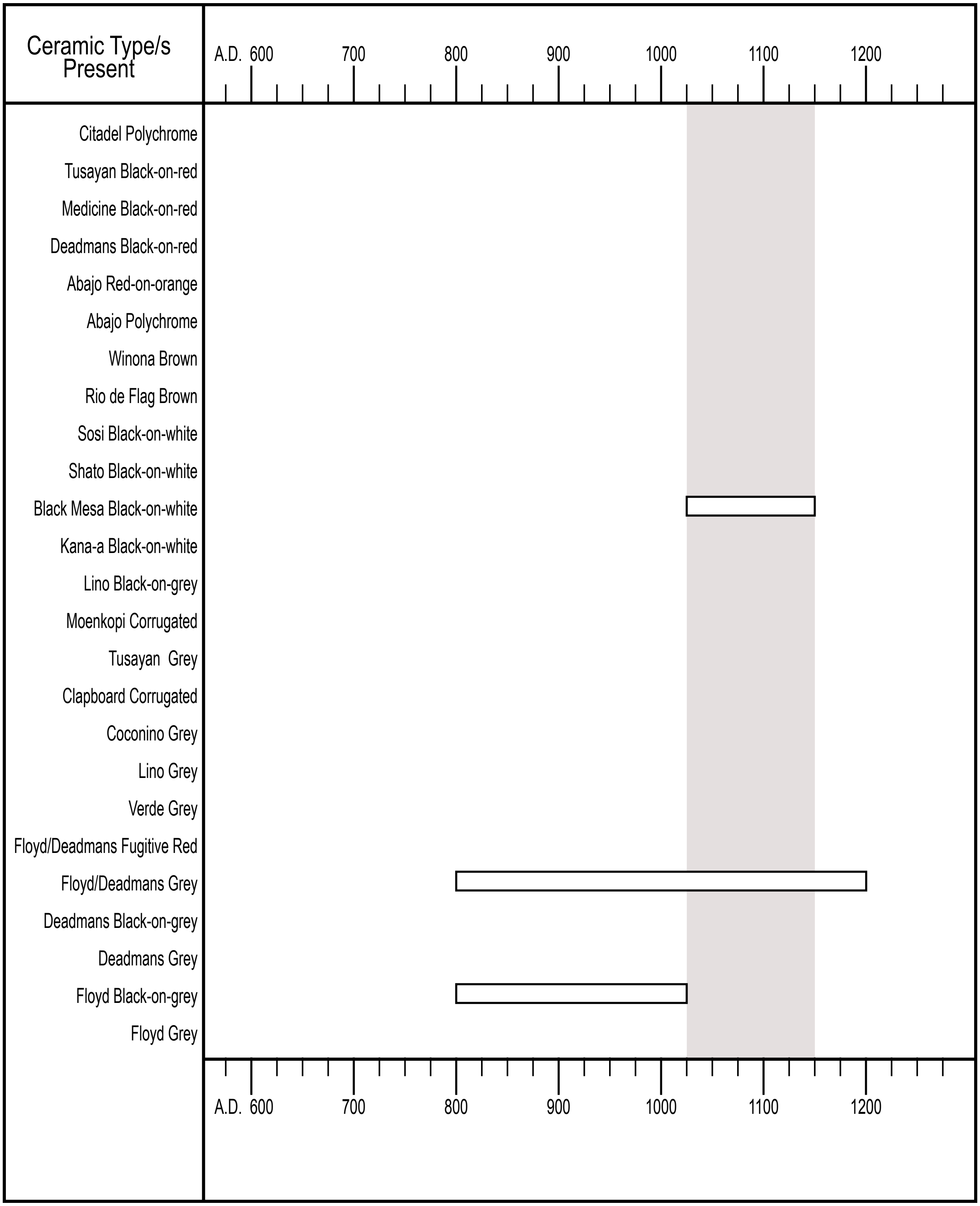


Figure B.29. Site 03070102786 Chronogram.

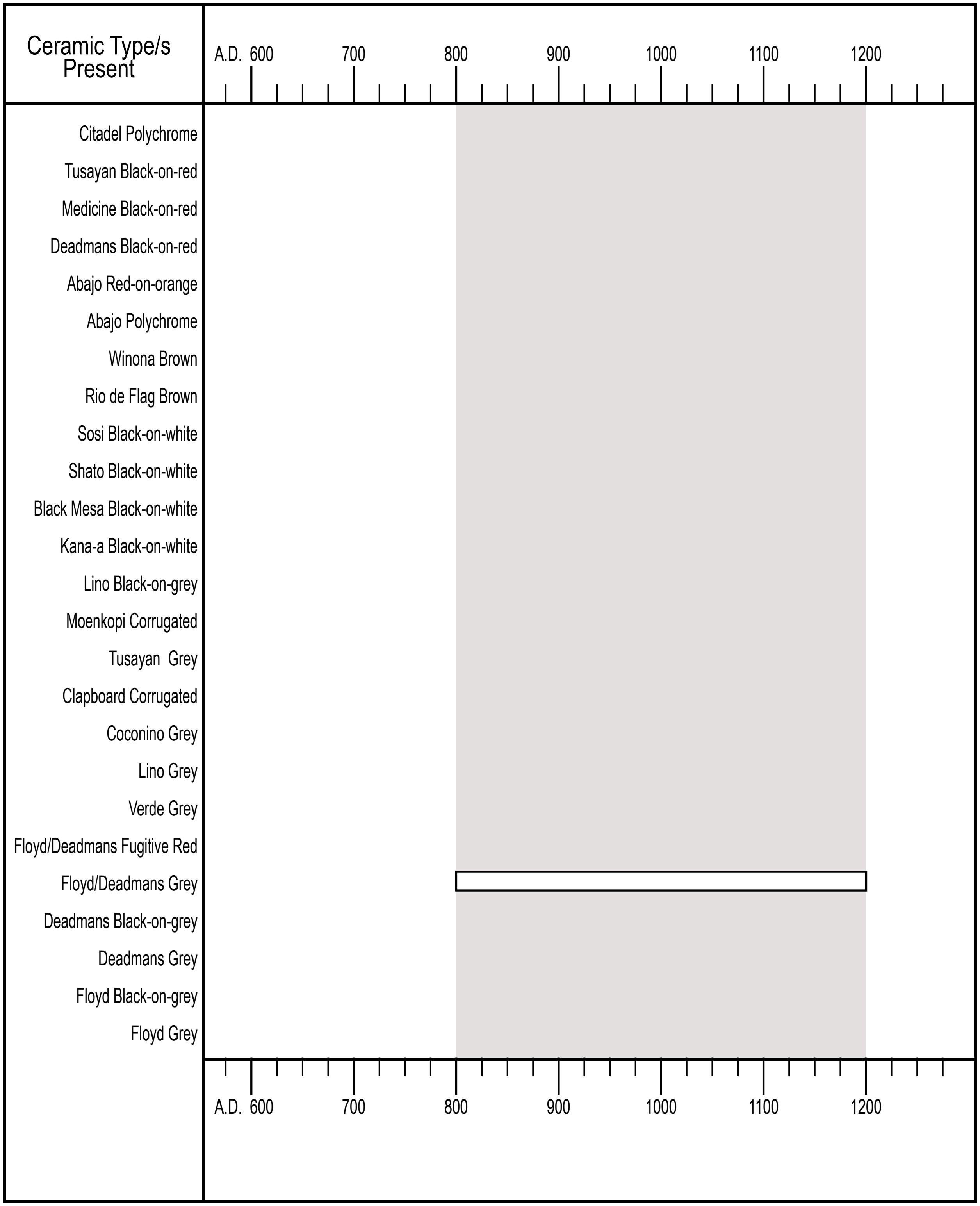


Figure B.30. Site 03070102788 Chronogram.

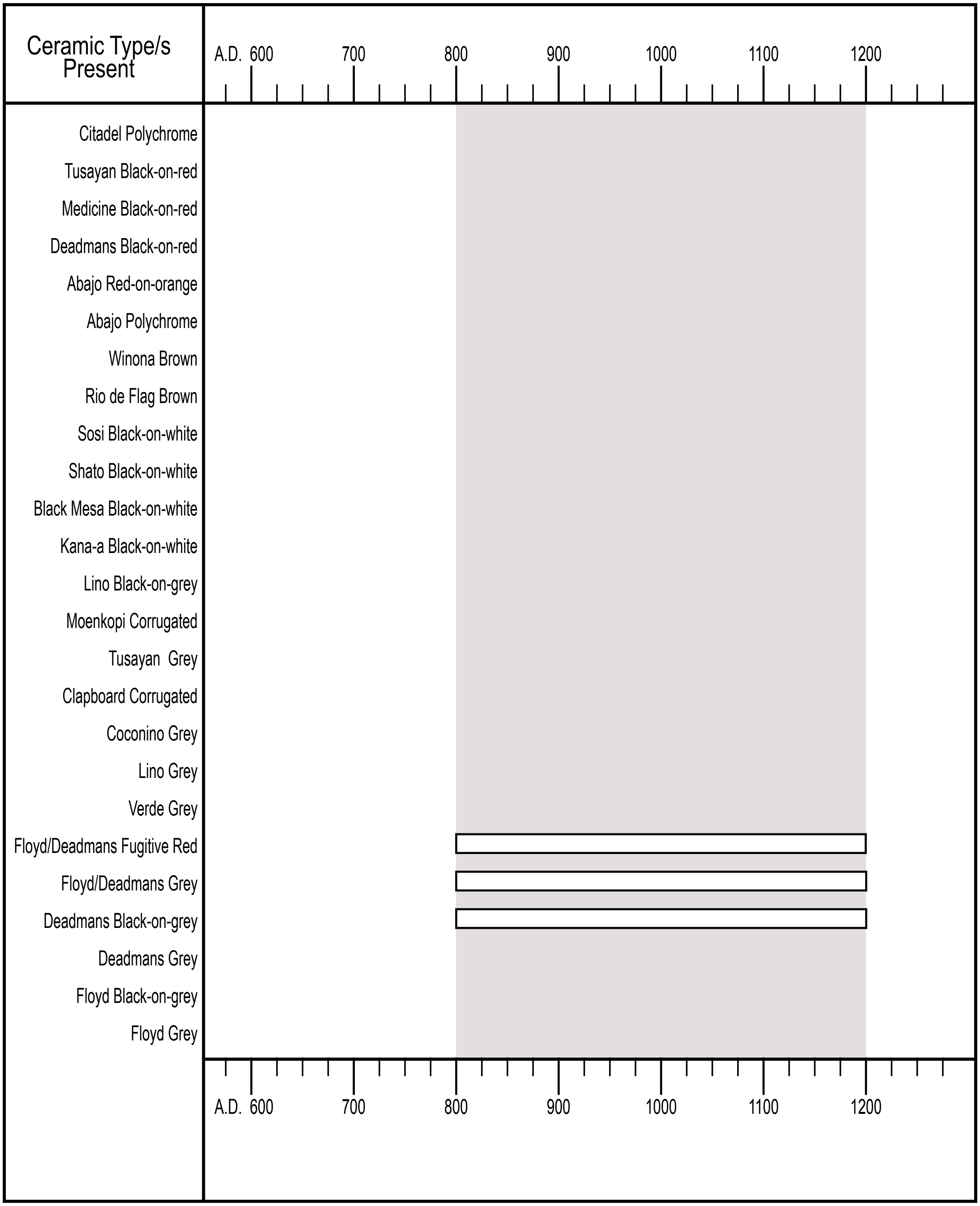
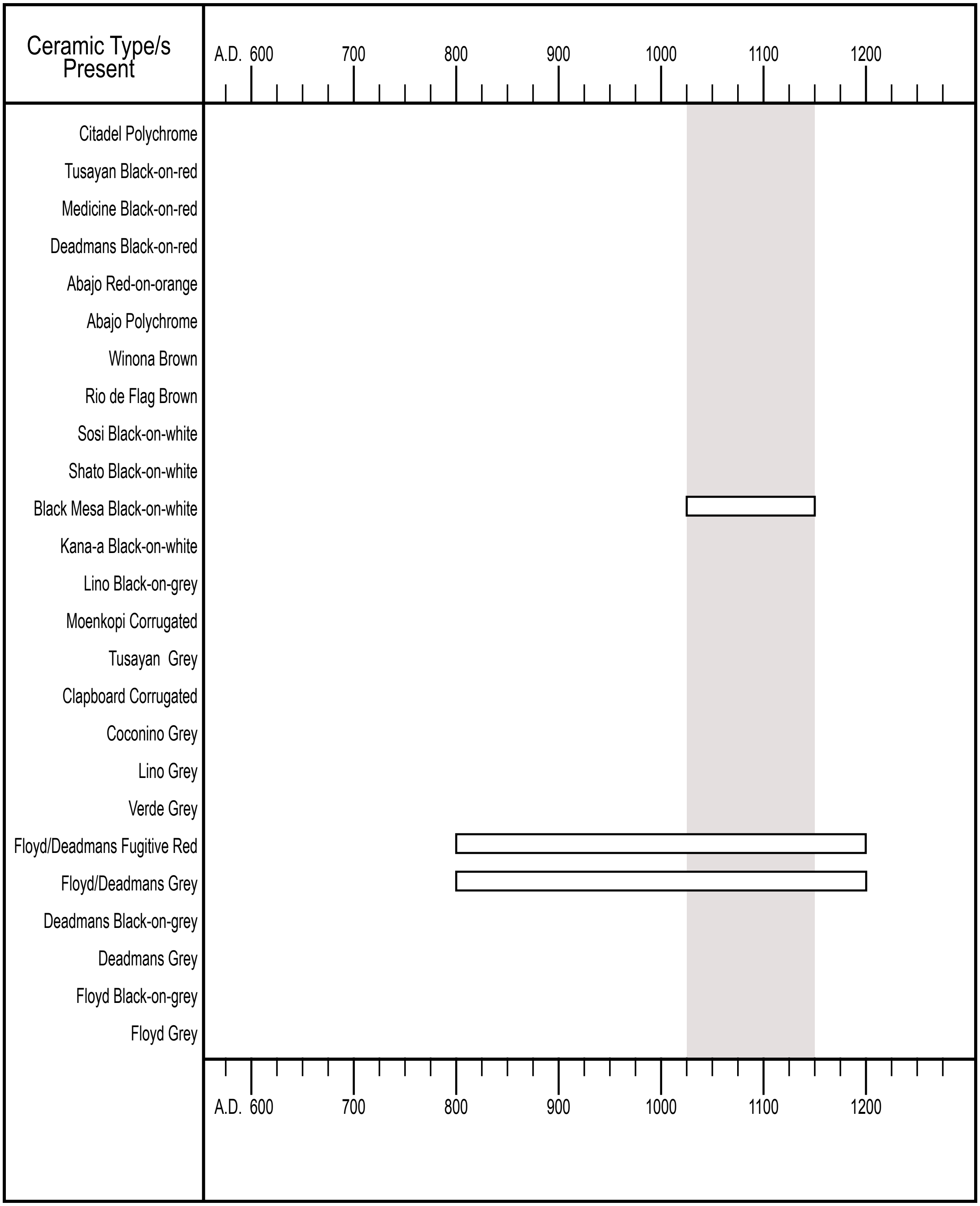


Figure B.31. Site 03070102792 Chronogram.



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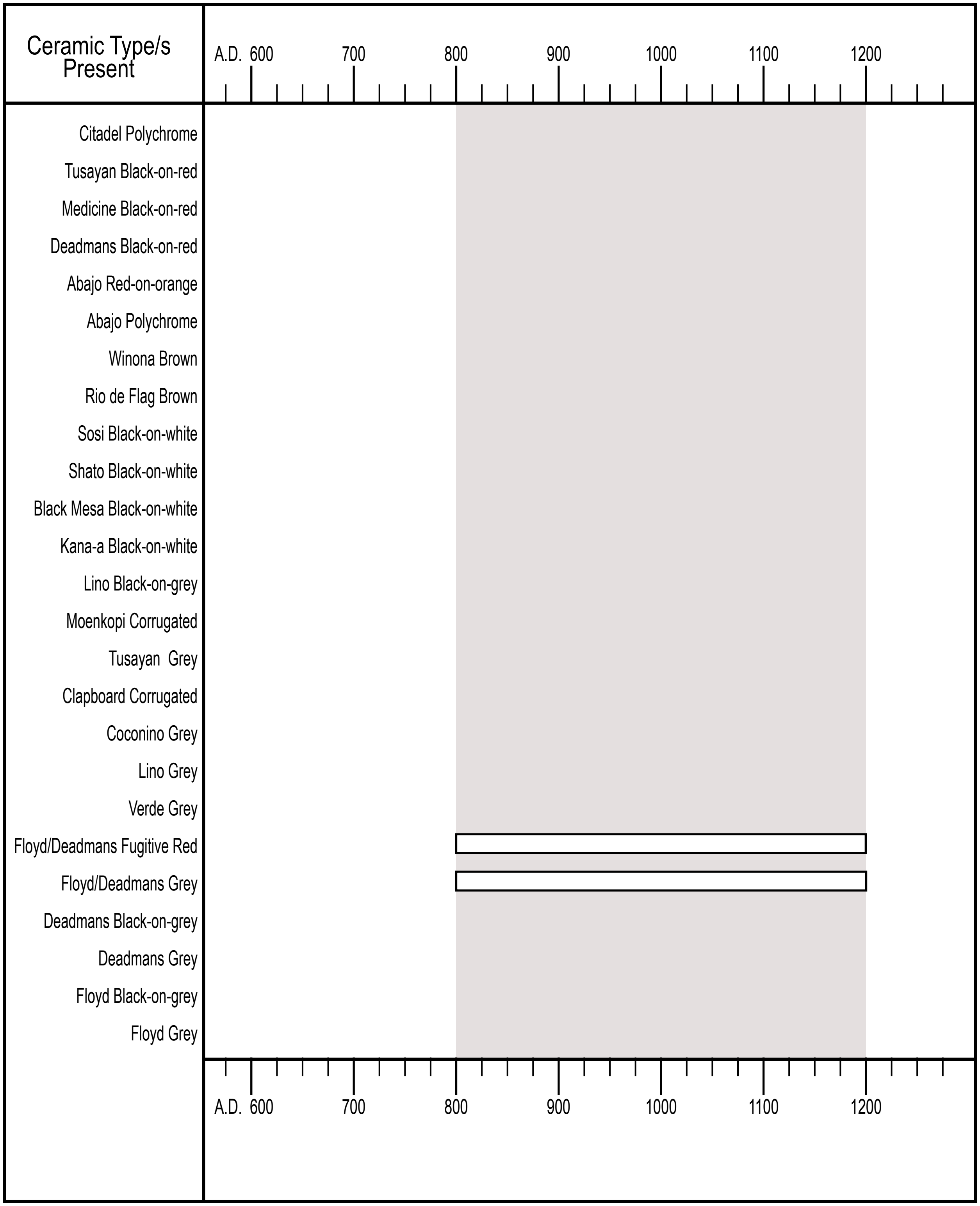

Figure B.33. Site 03070102795 Chronogram.

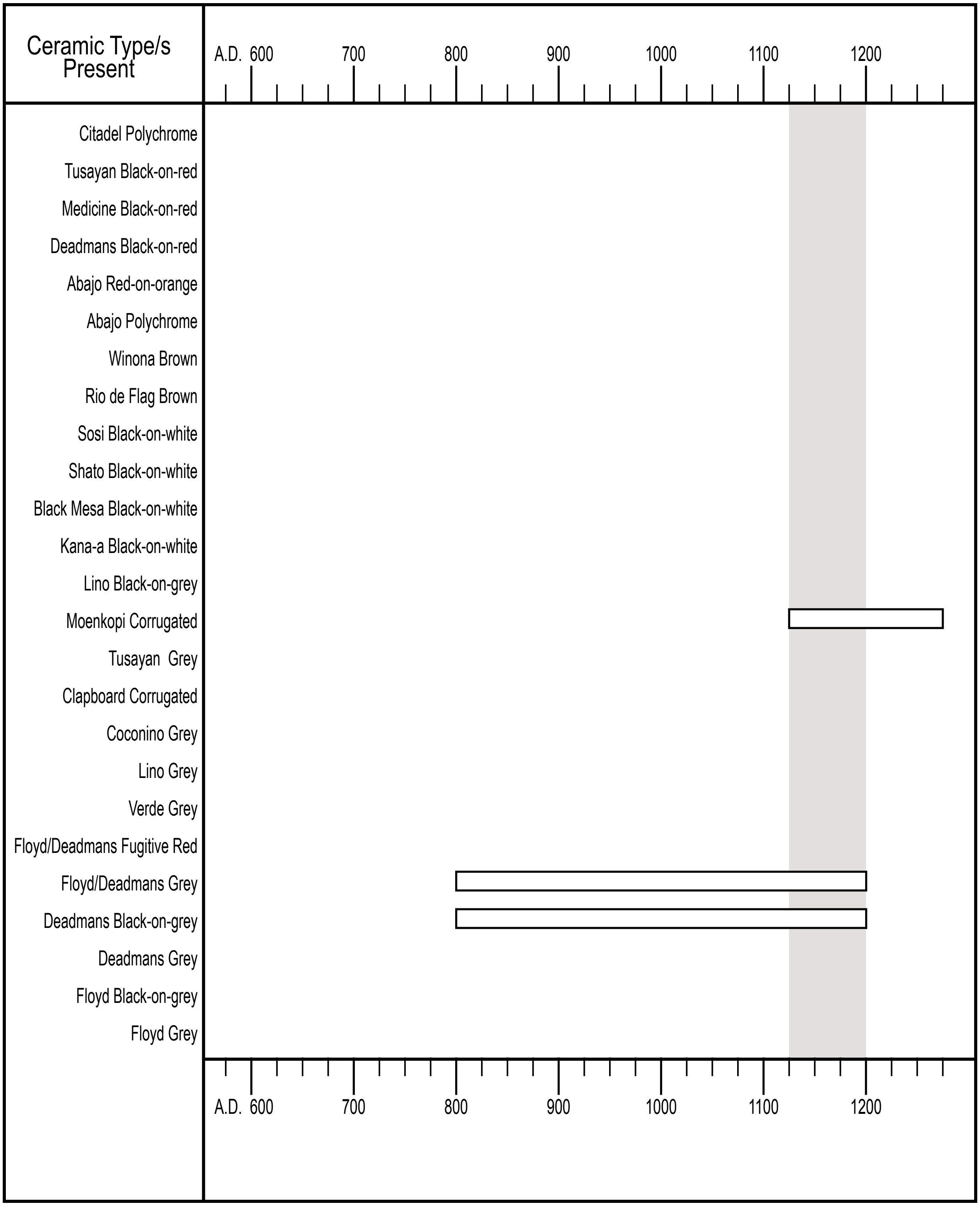

Figure B.34. Site 03070102796 Chronogram.

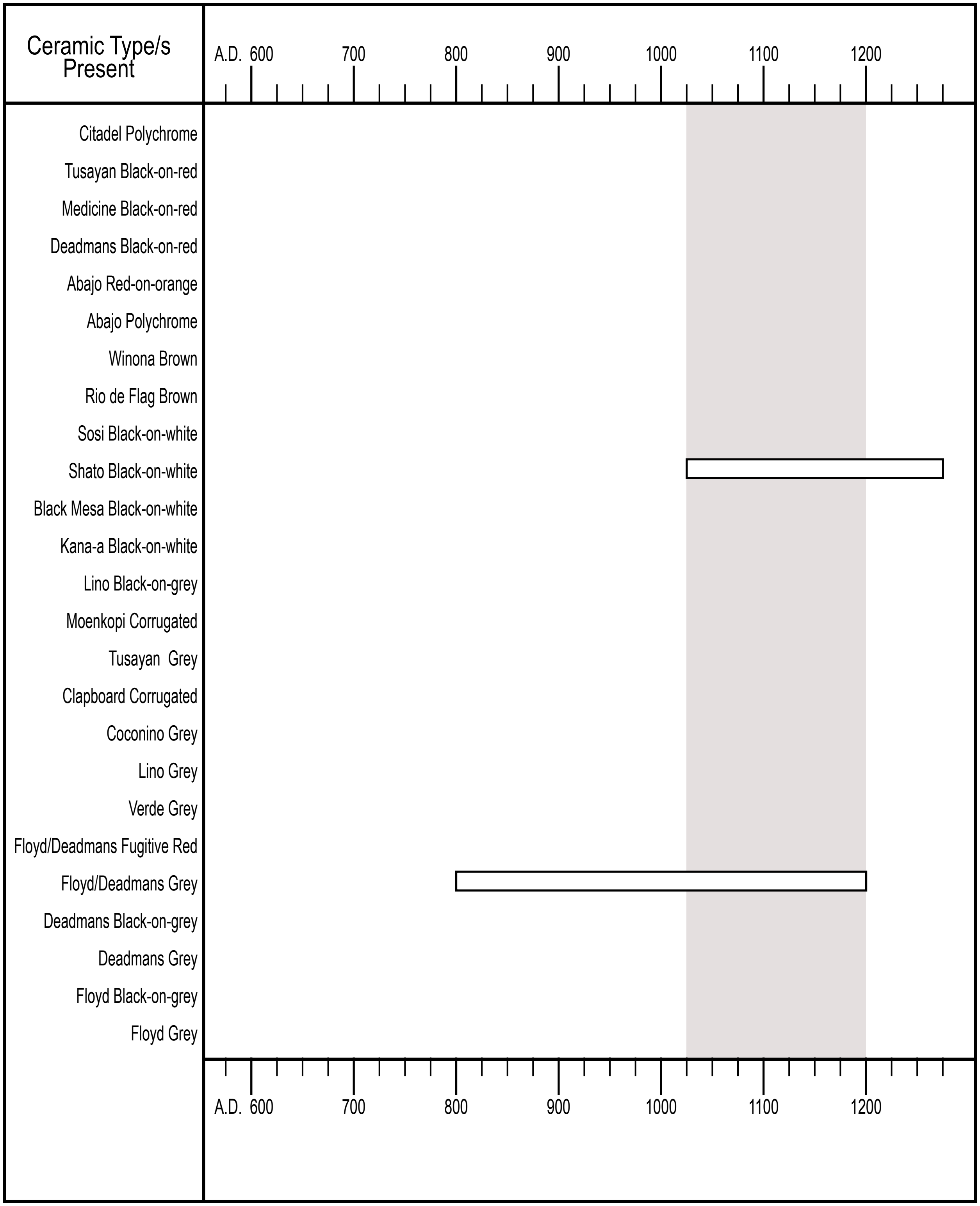

Figure B.35. Site 03070102800 Chronogram.

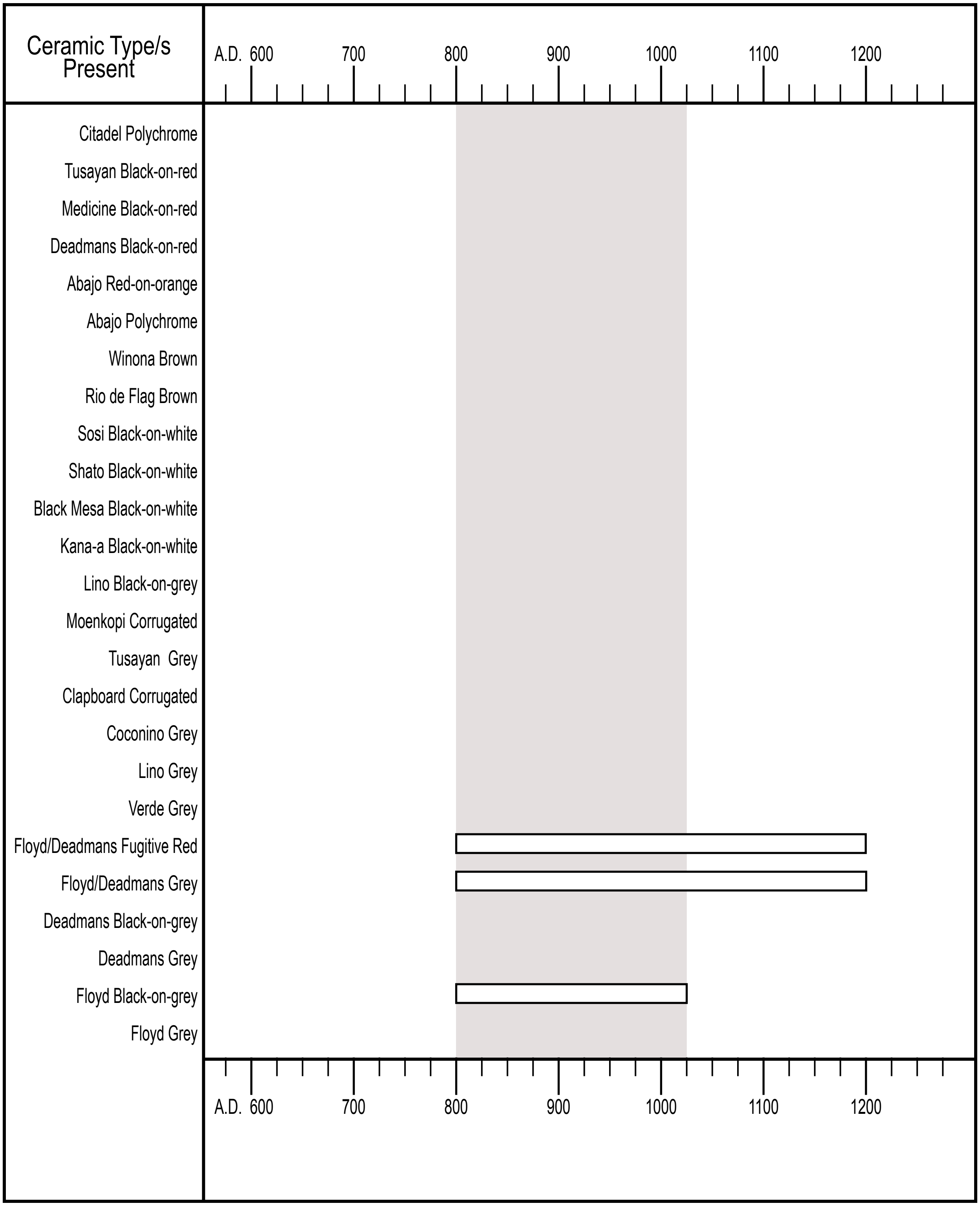

Figure B.36. Site 03070102801 Chronogram.

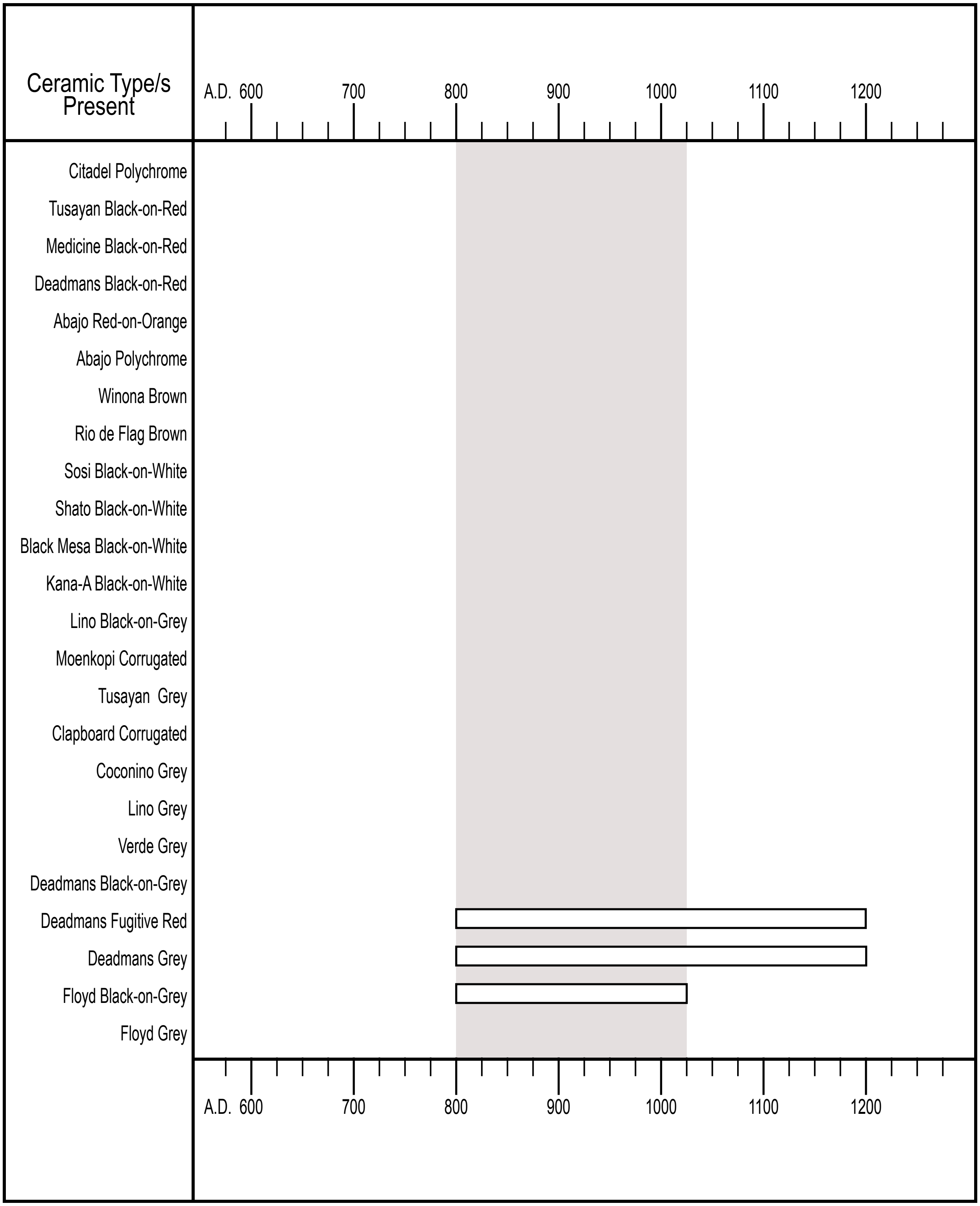

Figure B.37. Site 03070102803 Chronogram.

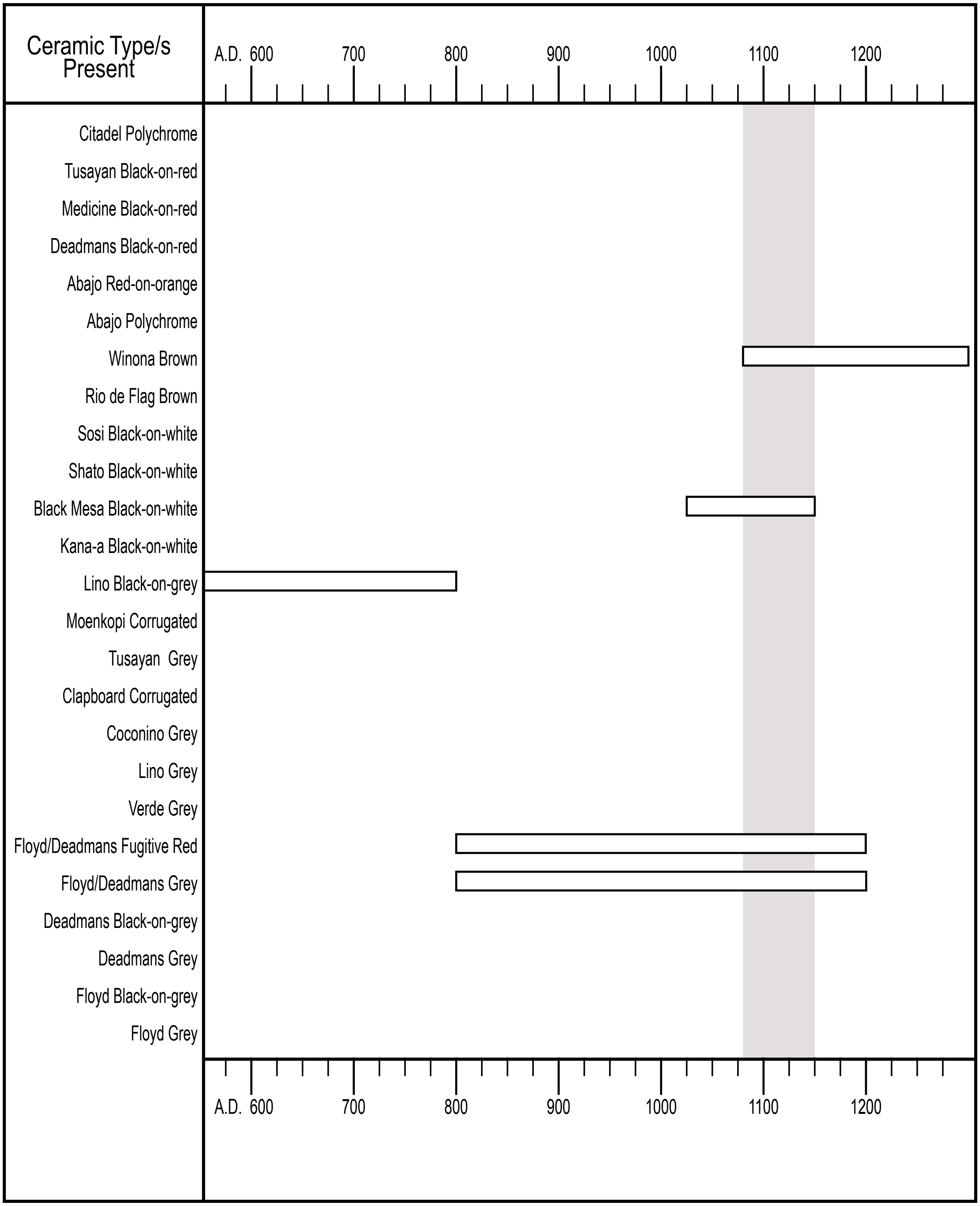

Figure B.38. Site 03070200132 Chronogram.

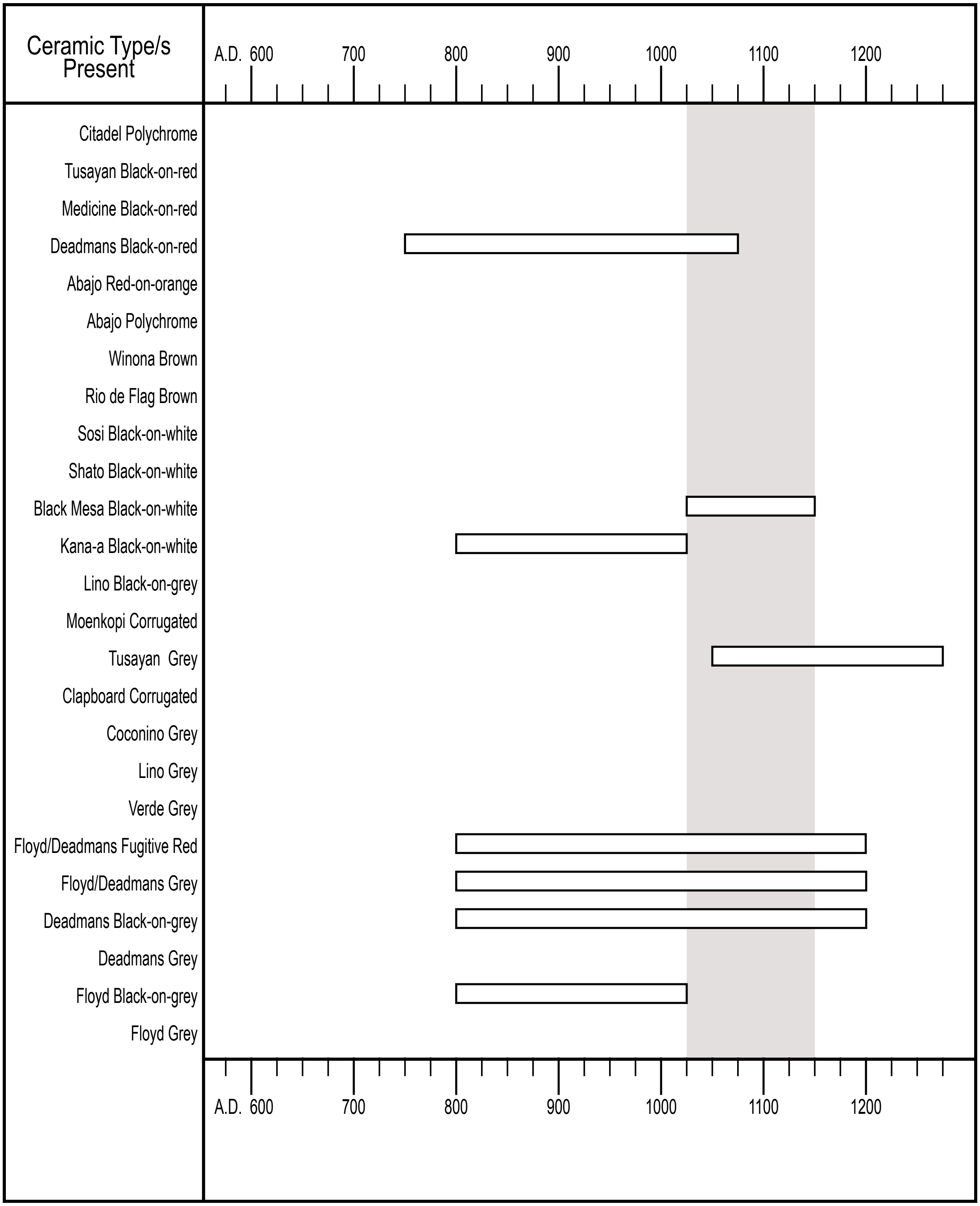

Figure B.39. Site 03070200140 Chronogram.

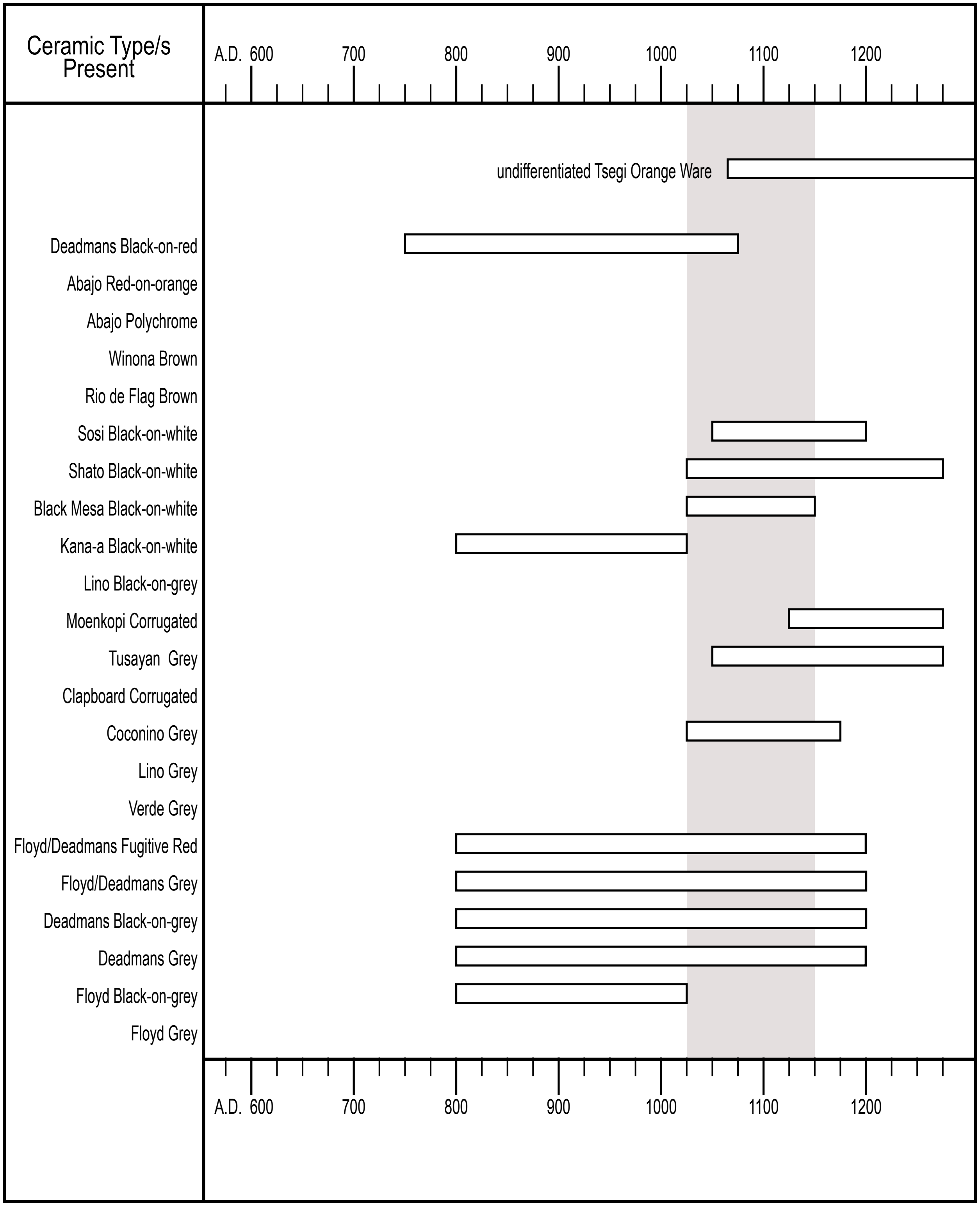

Figure B.40. Site 03070200152 Chronogram.

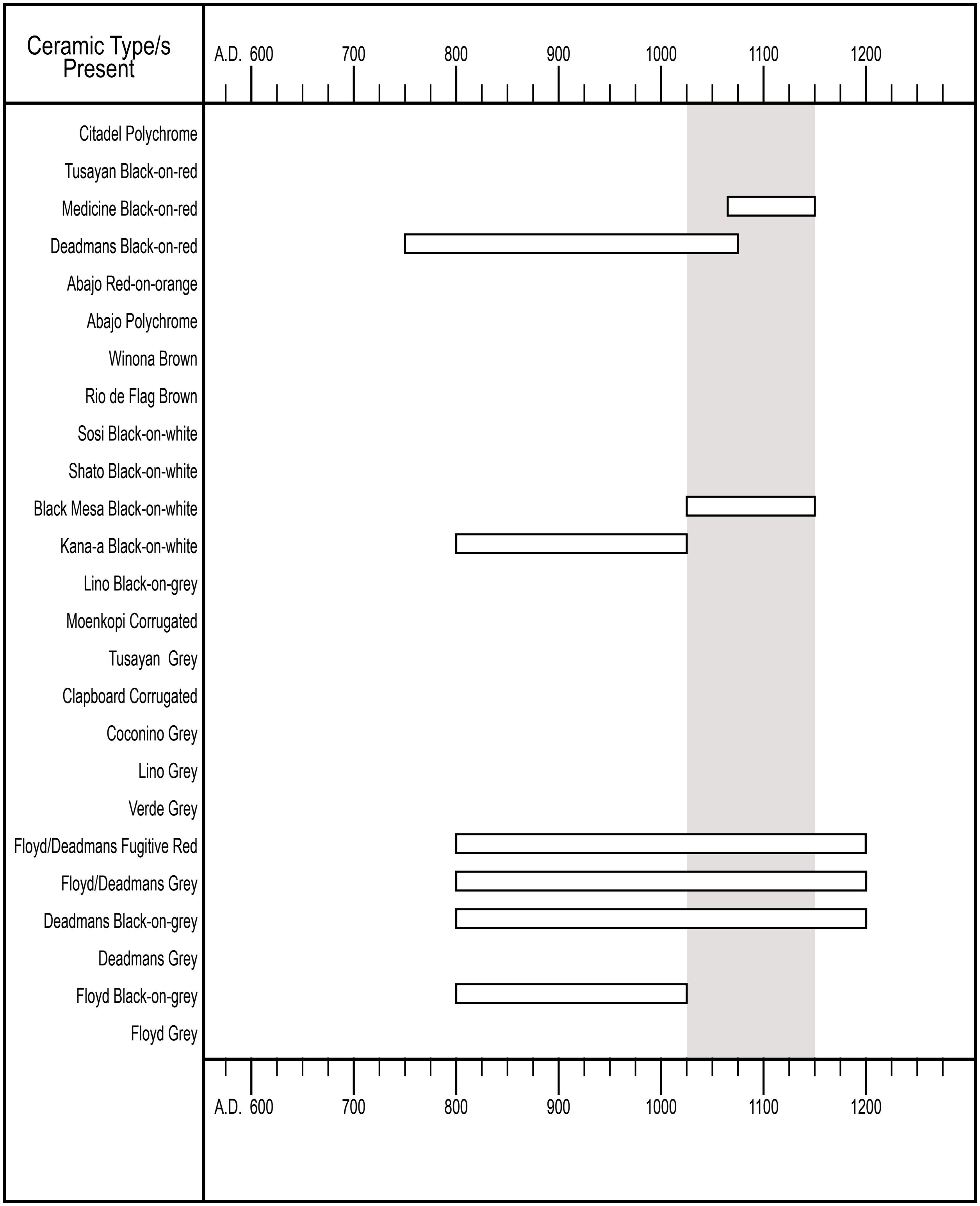

Figure B.41. Site 03070200316 Chronogram.

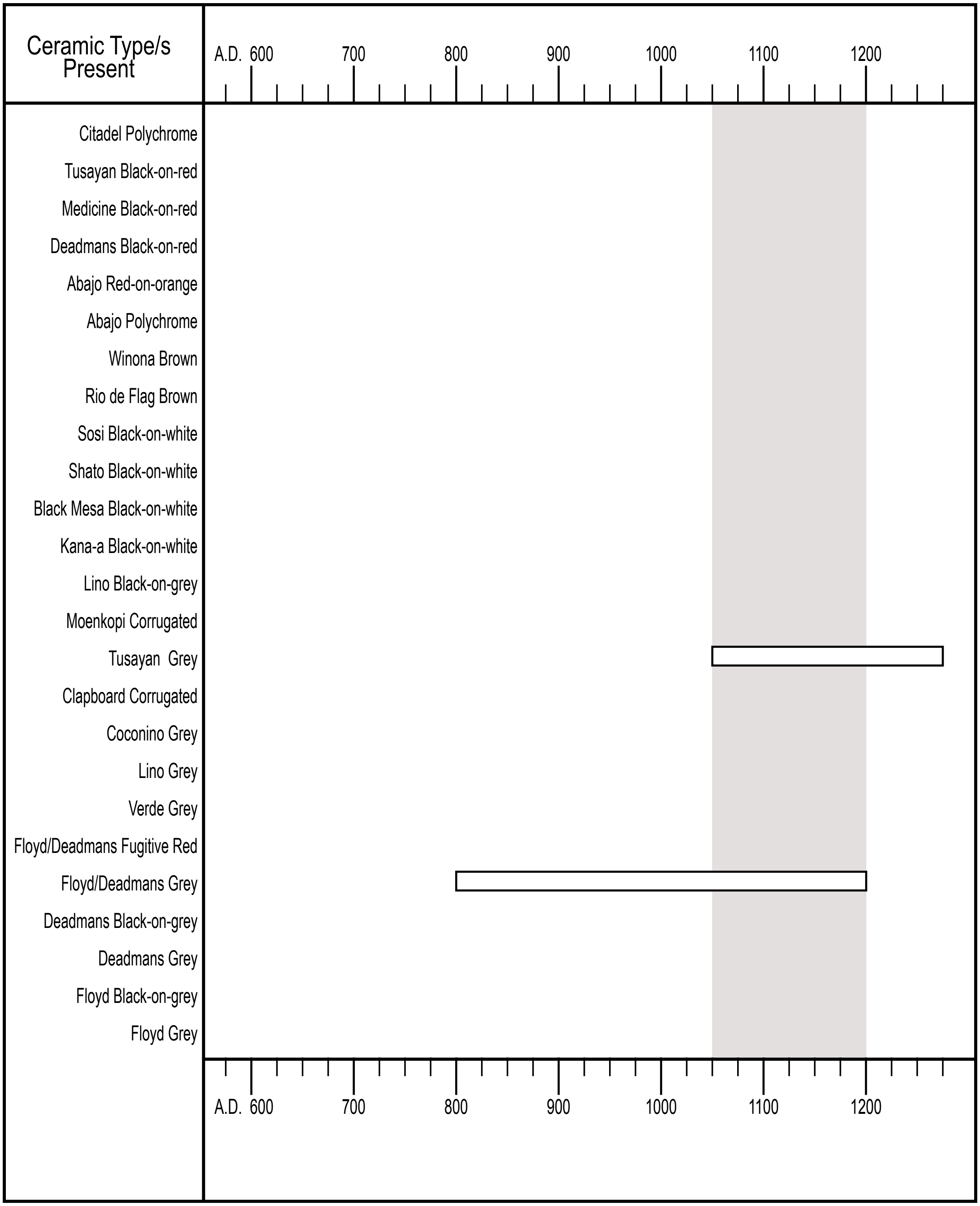

Figure B.42. Site 03070200534 Chronogram.

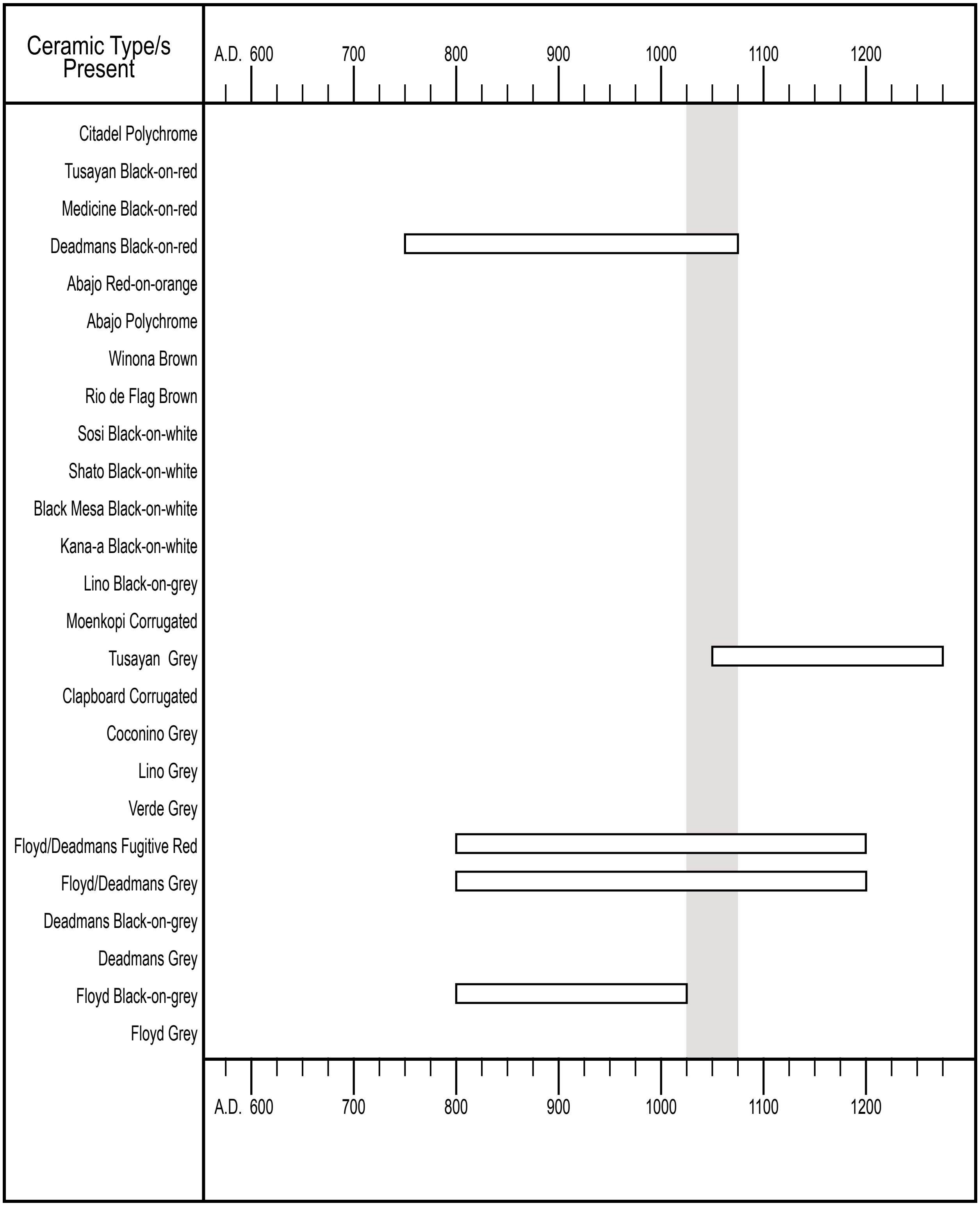

Figure B.43. Site 03070200706 Chronogram.

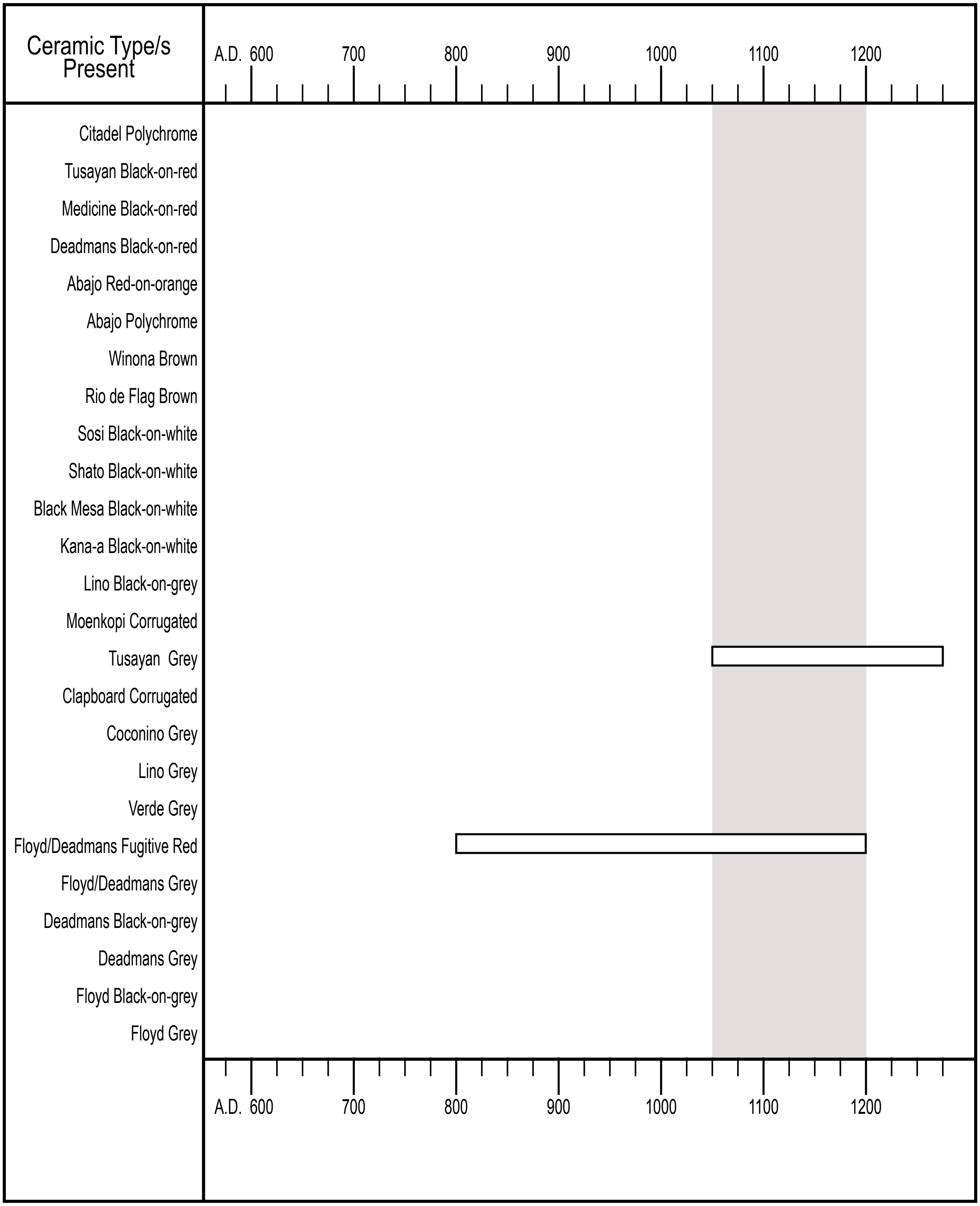

Figure B.44. Site 03070200708 Chronogram.

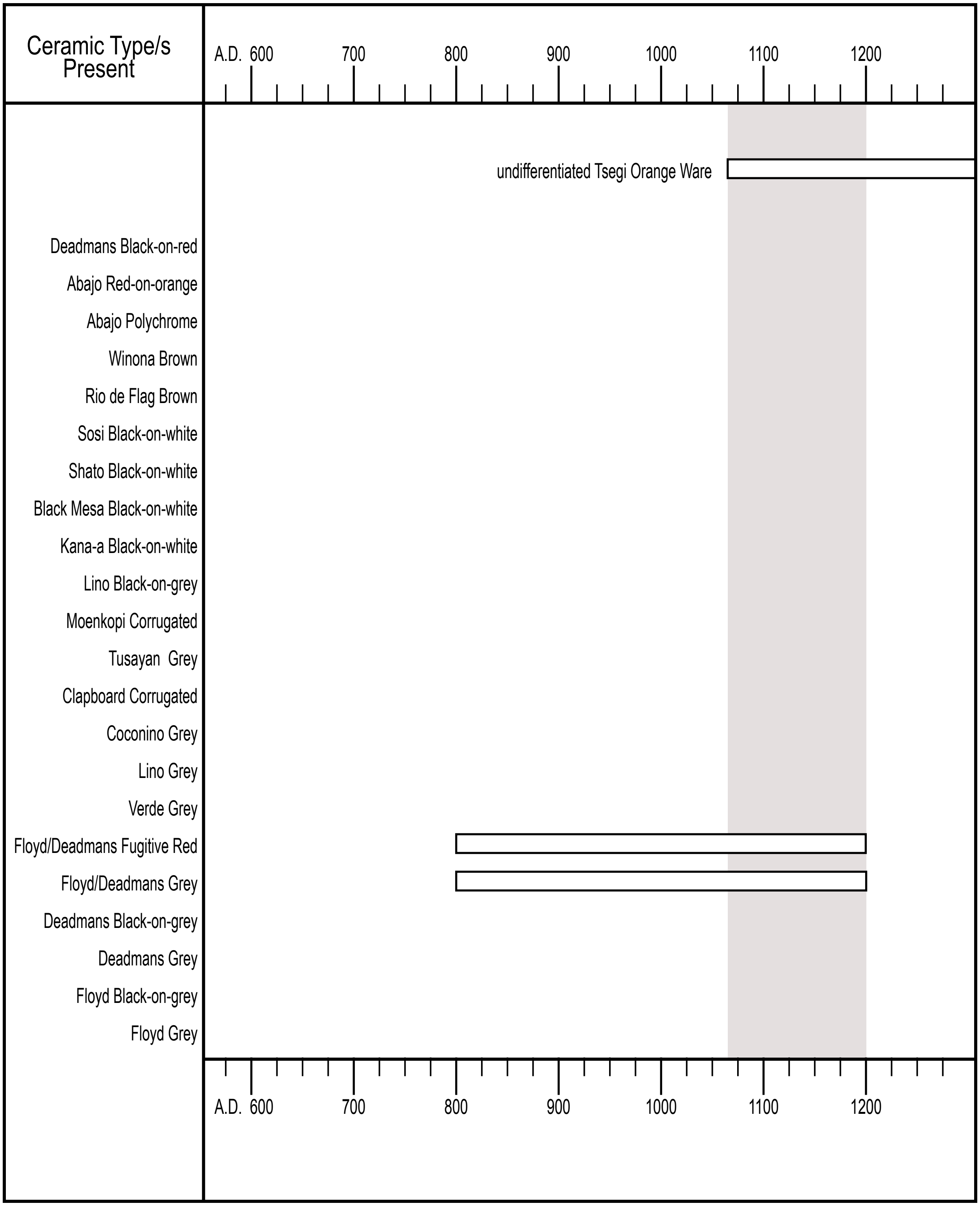

Figure B.45. Site 03070200804 Chronogram.

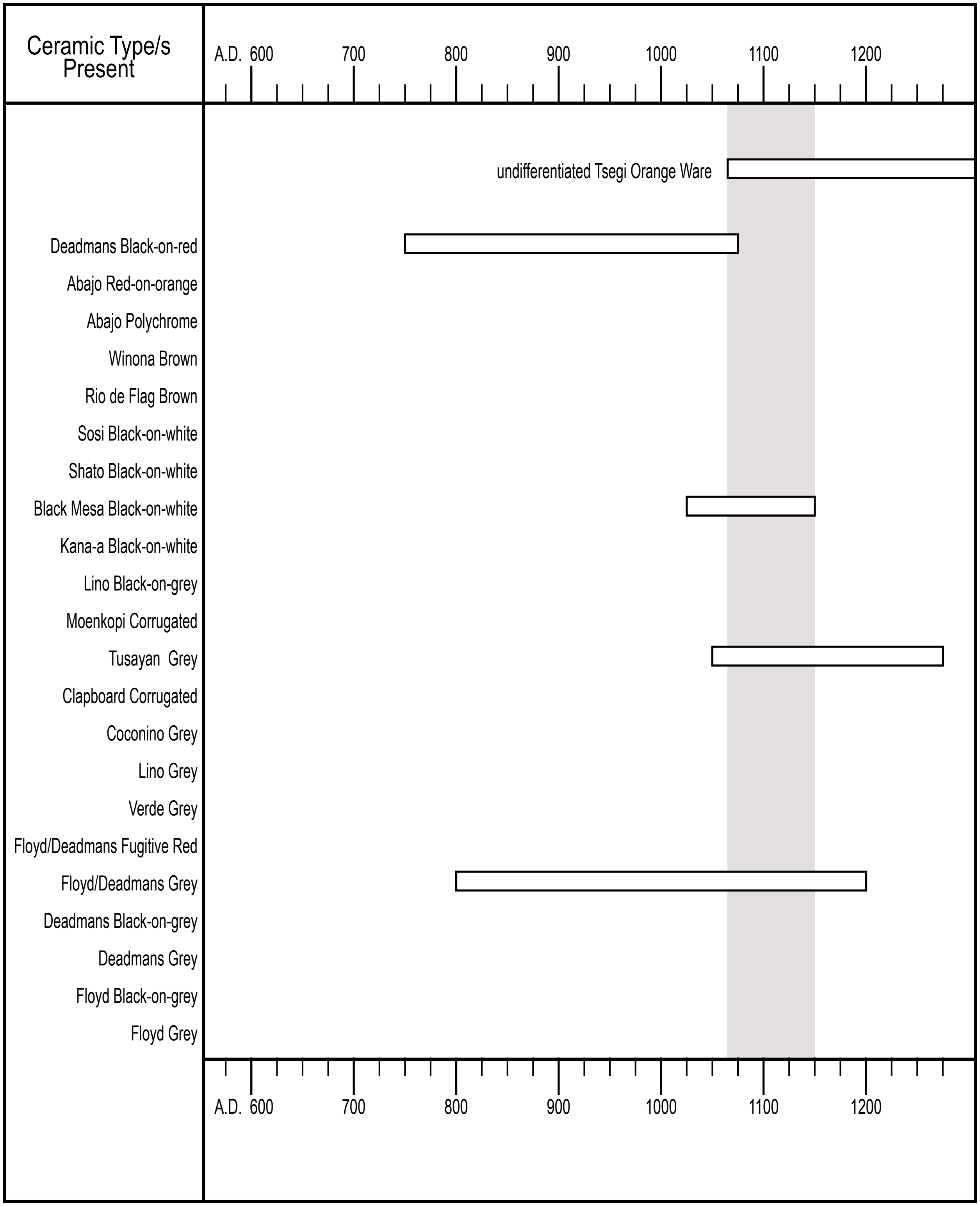

Figure B.46. Site 03070200836 Chronogram.

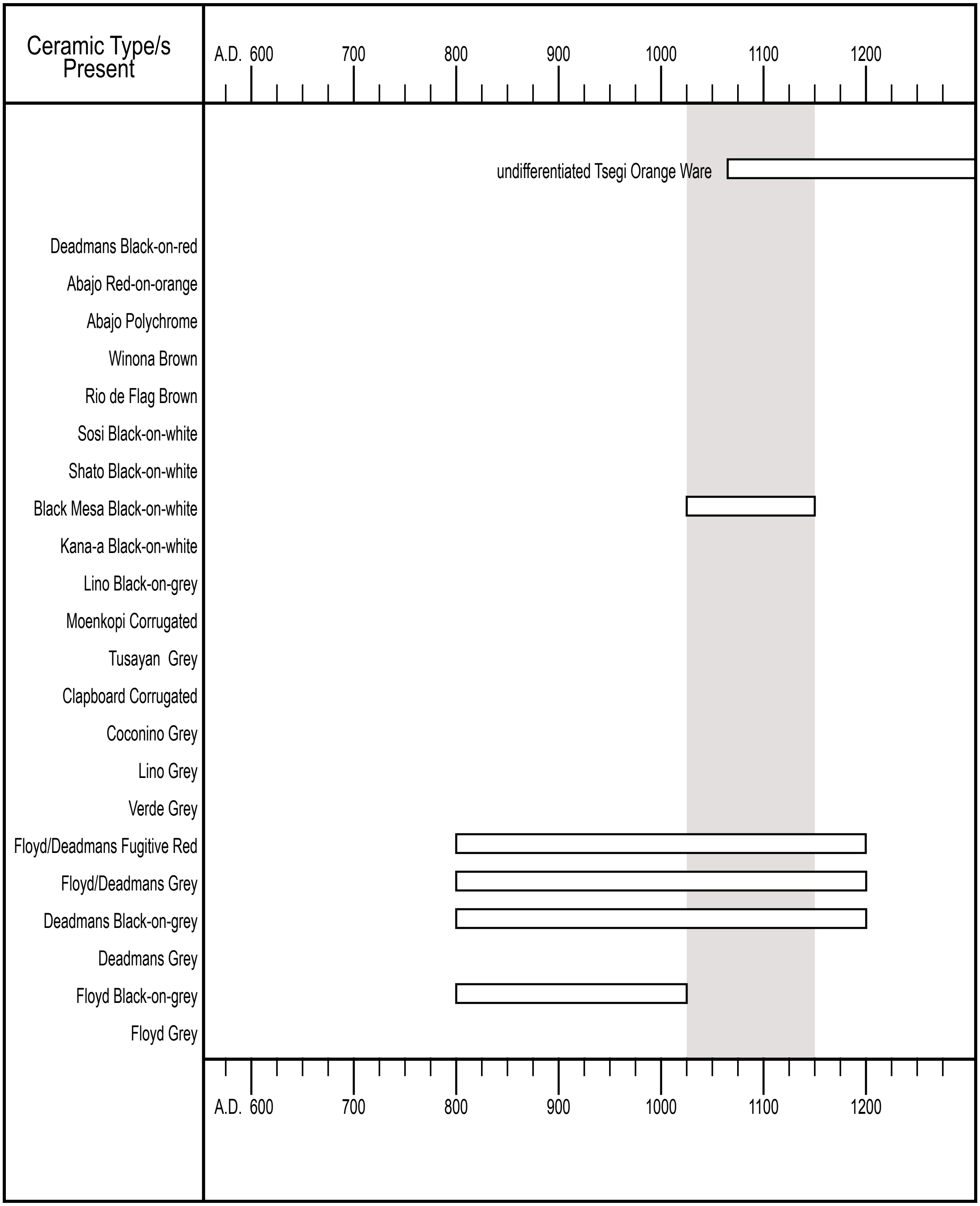

Figure B.47. Site 03070201385 Chronogram.

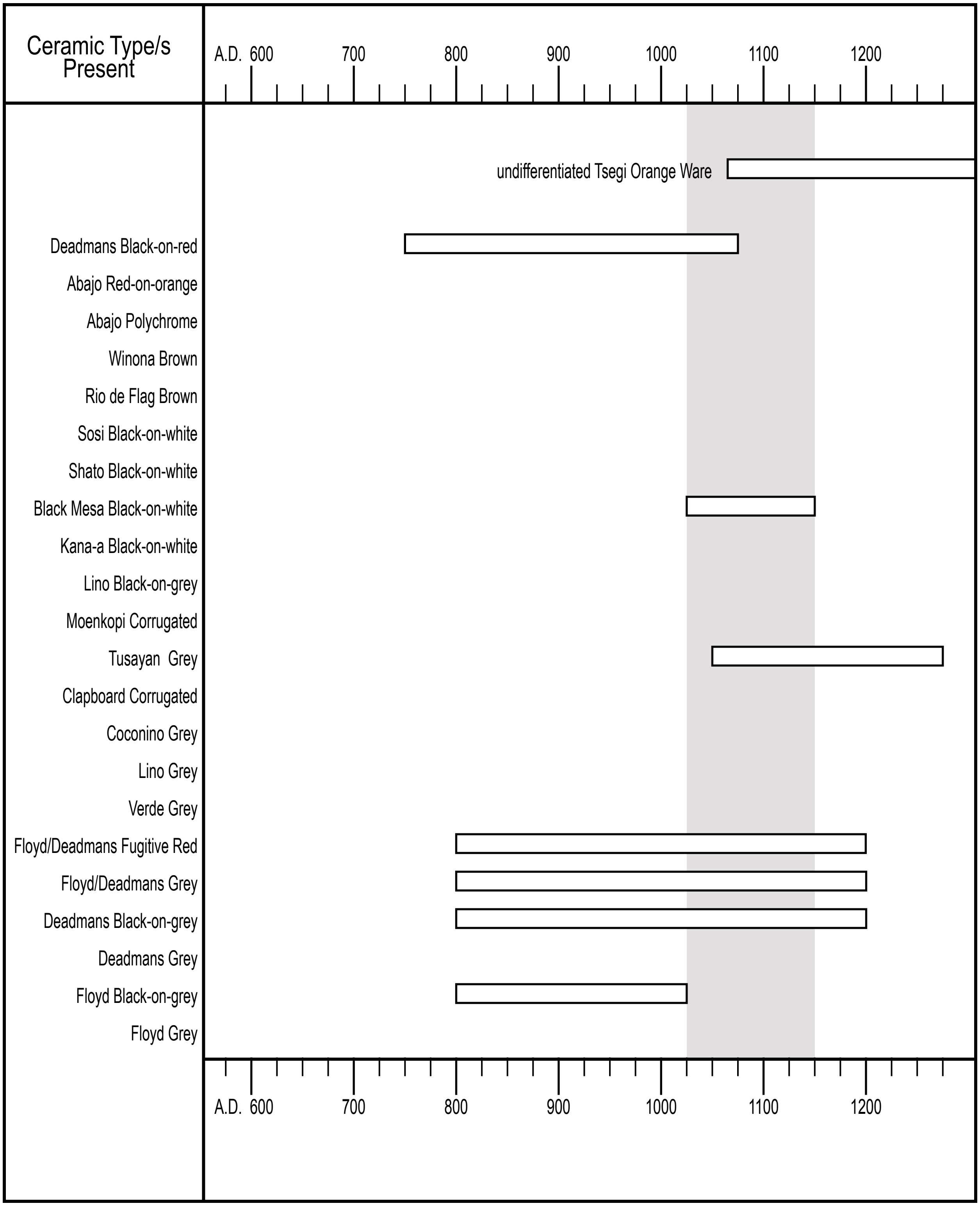

Figure B.48. Site 03070201456 Chronogram.

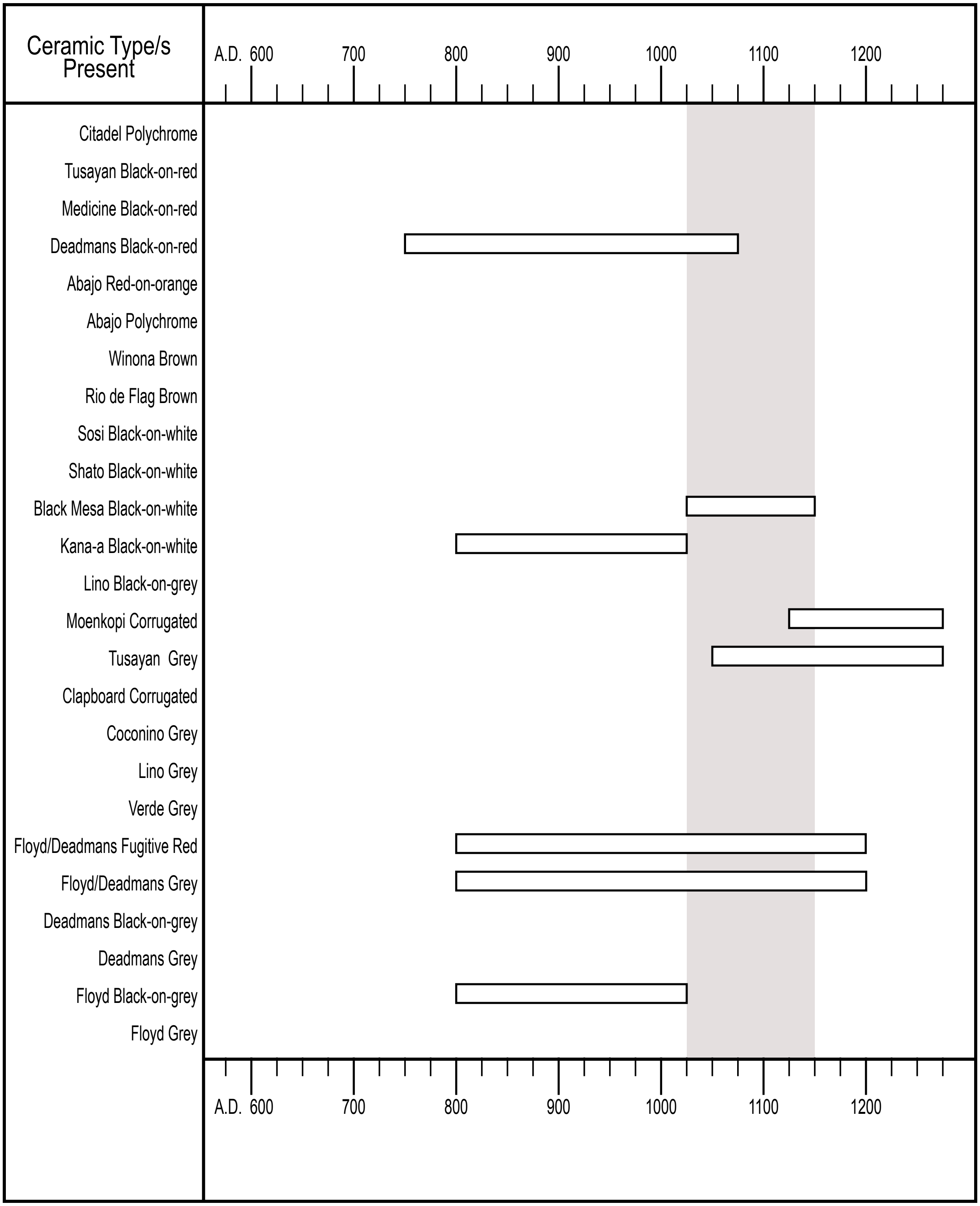

Figure B.49. Site 03070201457 Chronogram.

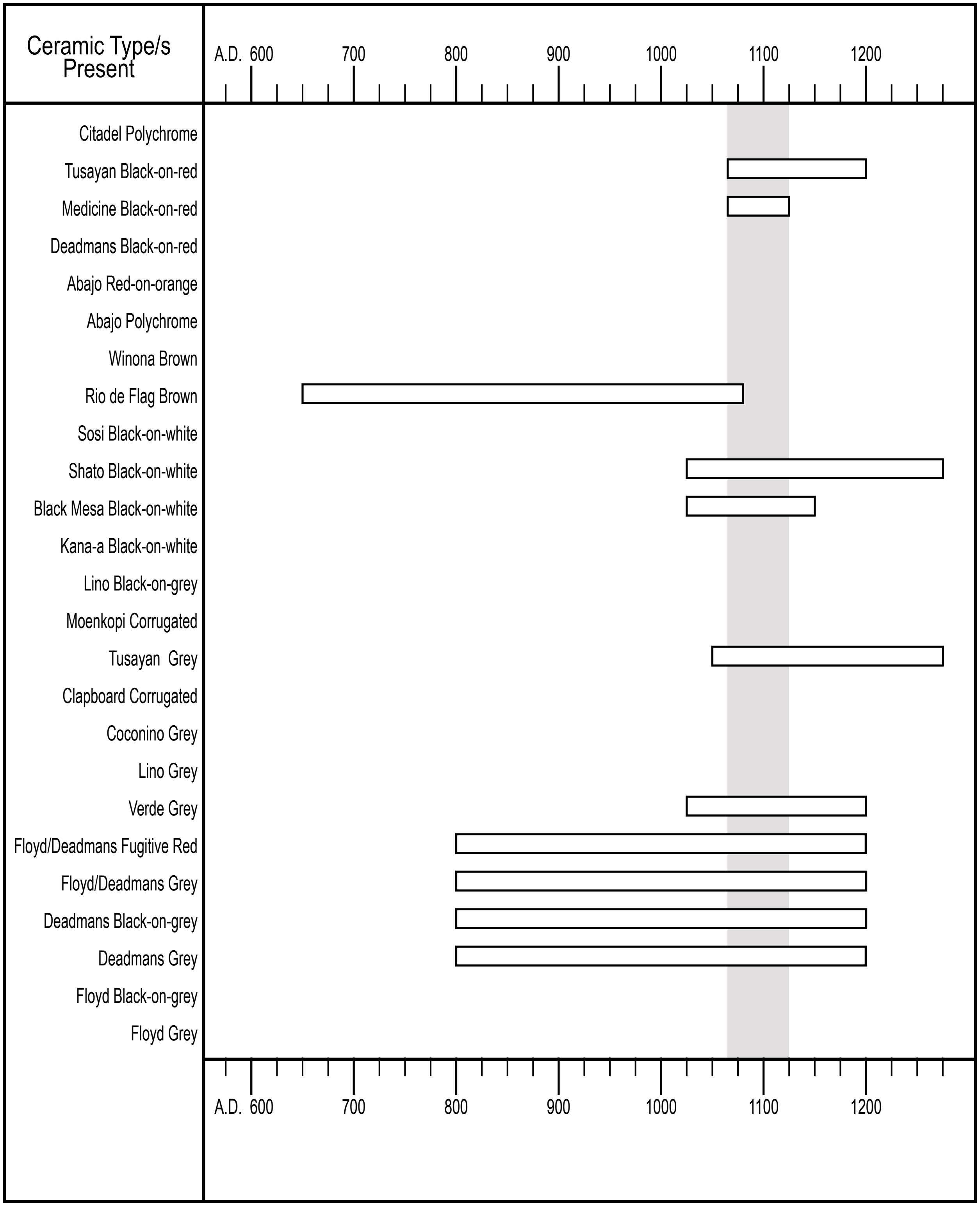

Figure B.50. Site NA355 Chronogram.

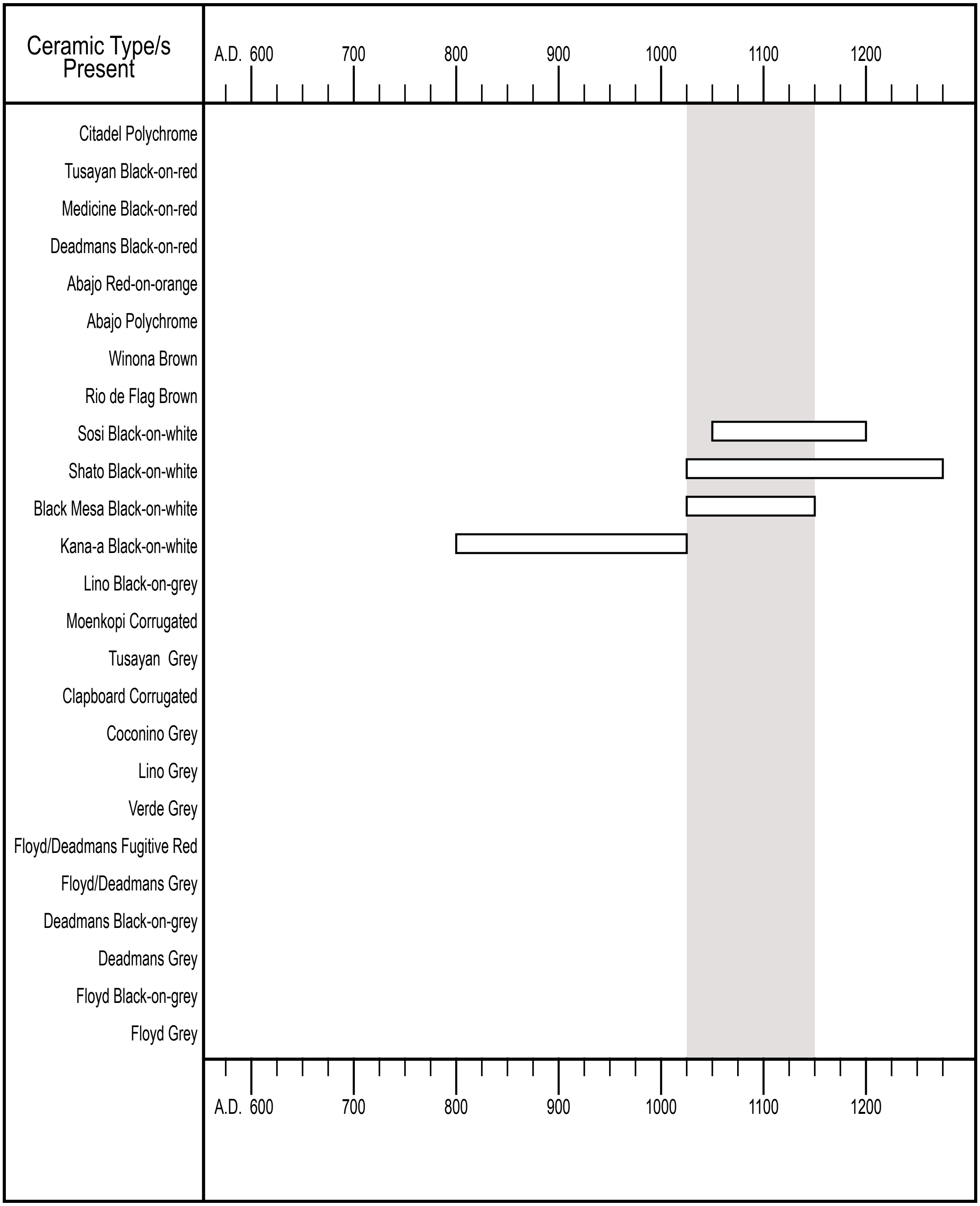

Figure B.51. Site NA862 Chronogram.

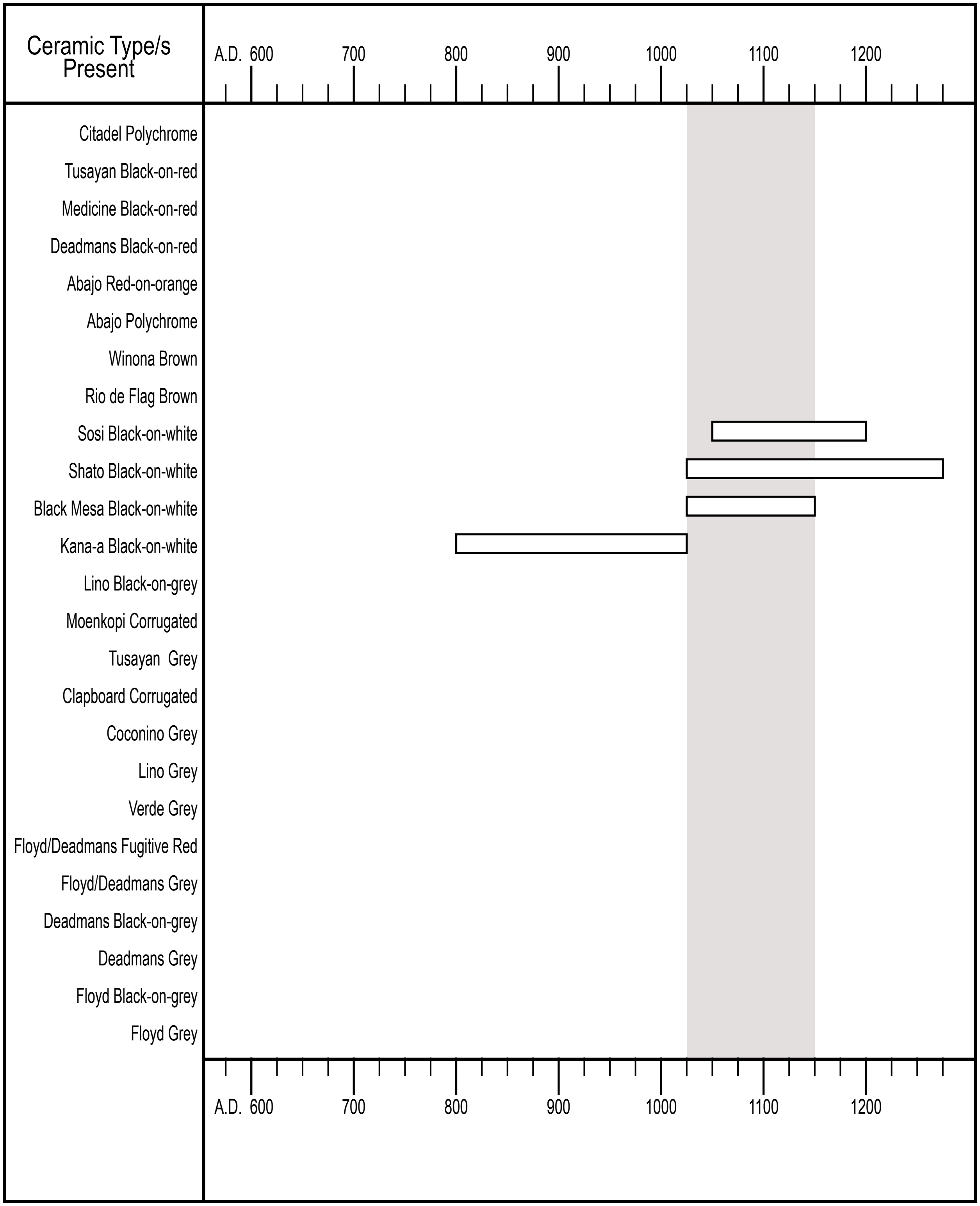

Figure B.52. Site NA1765 Chronogram.

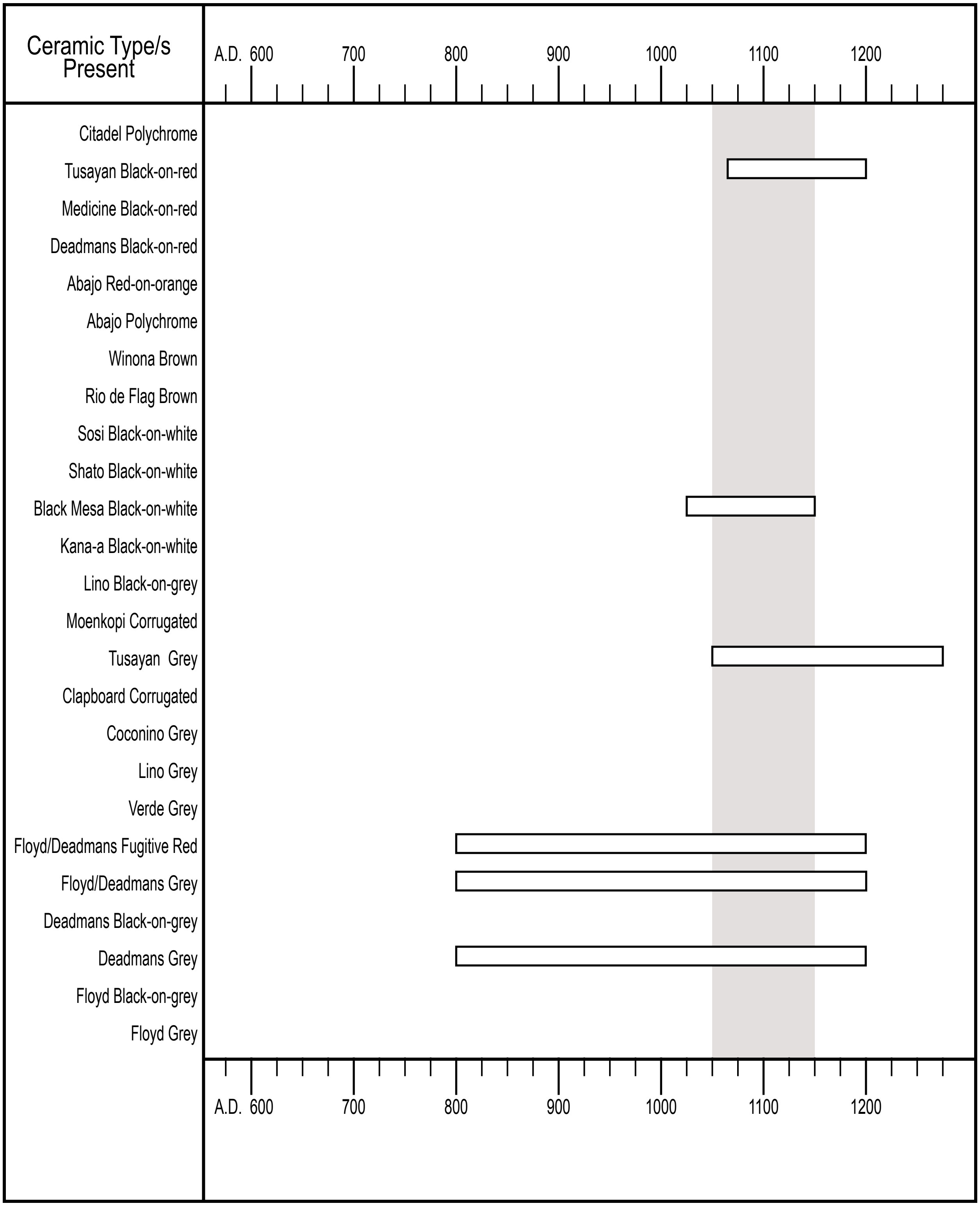

Figure B.53. Site NA1814 Chronogram.

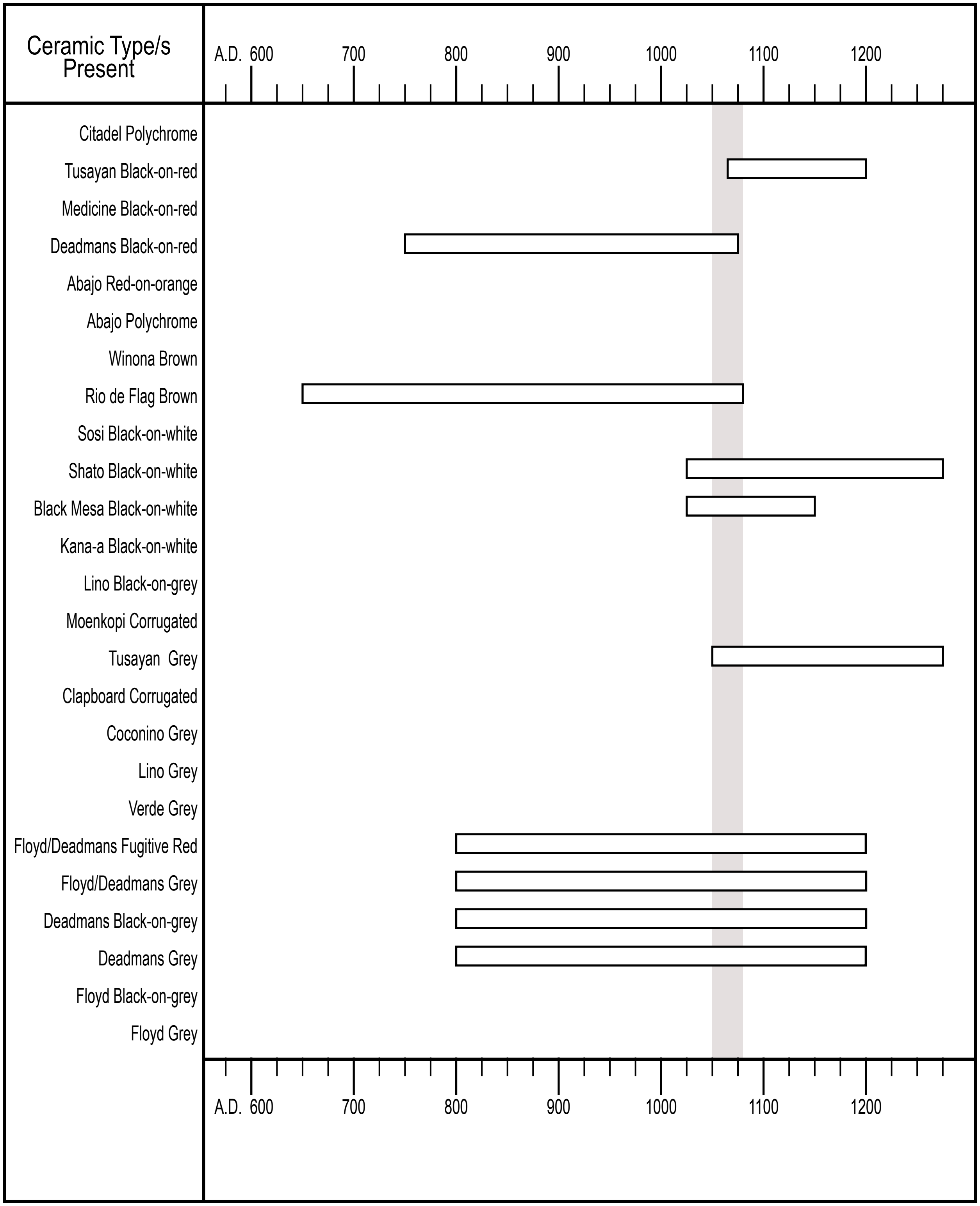

Figure B.54. Site NA5145 Chronogram.

Mean Sherd Thickness Data

Table B.3. Site 03070100238 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 0238 Surface	5.700mm	5.30mm	5.60mm	-	5.533mm
2	Site 0238 Surface	4.000mm	4.20mm	4.20mm	3.60mm	4.000mm
3	Site 0238 Surface	5.200mm	5.00mm	5.30mm	-	5.167mm
4	Site 0238 Surface	4.000mm	3.90mm	5.00mm	-	4.300mm
5	Site 0238 Surface	4.800mm	4.90mm	4.90mm	-	4.867mm
6	Site 0238 Surface	4.500mm	4.70mm	5.10mm	5.20mm	4.875mm
7	Site 0238 Surface	3.200mm	3.30mm	3.30mm	-	3.267mm
8	Site 0238 Surface	4.900mm	5.00mm	-	-	4.950mm
9	Site 0238 Surface	4.200mm	4.30mm	-	-	4.250mm
10	Site 0238 Surface	3.600mm	-	-	-	3.600mm
11	Site 0238 Surface	5.000mm	5.10mm	5.50mm	5.40mm	5.250mm
12	Site 0238 Surface	4.600mm	4.50mm	4.70mm	4.70mm	4.625mm
13	Site 0238 Surface	4.100mm	4.20mm	4.70mm	4.80mm	4.450mm
14	Site 0238 Surface	3.800mm	-	-	-	3.800mm
15	Site 0238 Surface	5.400mm	5.50mm	5.80mm	-	5.567mm
16	Site 0238 Surface	4.700mm	4.60mm	-	-	4.650mm
17	Site 0238 Surface	6.100mm	6.30mm	6.50mm	6.80mm	6.425mm
18	Site 0238 Surface	3.700mm	-	-	-	3.700mm
19	Site 0238 Surface	4.100mm	-	-	-	4.100mm
20	Site 0238 Surface	4.200mm	-	-	-	4.200mm
21	Site 0238 Surface	3.400mm	3.20mm	-	-	3.300mm
22	Site 0238 Surface	4.600mm	4.70mm	4.60mm	-	4.633mm
23	Site 0238 Surface	4.400mm	4.70mm	4.50mm	4.50mm	4.525mm
24	Site 0238 Surface	4.200mm	3.50mm	3.70mm	4.00mm	3.850mm
25	Site 0238 Surface	5.300mm	5.10mm	-	-	5.200mm
26	Site 0238 Surface	4.300mm	4.20mm	4.60mm	-	4.367mm
27	Site 0238 Surface	4.500mm	4.70mm	-	-	4.600mm
28	Site 0238 Surface	6.700mm	6.40mm	6.60mm	6.40mm	6.525mm
29	Site 0238 Surface	4.200mm	4.20mm	-	-	4.200mm
30	Site 0238 Surface	4.300mm	4.80mm	-	-	4.550mm
31	Site 0238 Surface	5.300mm	5.20mm	4.90mm	5.40mm	5.200mm
32	Site 0238 Surface	4.900mm	5.20mm	-	-	5.050mm
33	Site 0238 Surface	4.700mm	5.50mm	5.20mm	-	5.133mm

		Date Estimate w/ 1 sigma Error		
Mean Site Thickness	4.628mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 894	A.D. 940	A.D. 986
Quadratic Reggression		A.D. 904	A.D. 946	A.D. 988

Table B.4. Site 03070101468 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 1468 Surface	5.08	5.54mm	5.76mm	5.96mm	5.585mm
2	Site 1468 Surface	5.04	5.07mm	5.43mm	5.35mm	5.223mm
3	Site 1468 Surface	5.36	5.67mm	5.59mm	5.10mm	5.430mm
4	Site 1468 Surface	5.48	5.95mm	5.77mm	5.68mm	5.720mm
5	Site 1468 Surface	6.5	6.24mm	6.42mm	6.52mm	6.420mm
6	Site 1468 Surface	6.19	6.34mm	5.79mm	6.51mm	6.208mm
7	Site 1468 Surface	6.64	6.04mm	6.49mm	6.12mm	6.323mm
8	Site 1468 Surface	6.11	5.00mm	5.30mm	5.67mm	5.520mm
9	Site 1468 Surface	6.22	6.89mm	6.67mm	6.63mm	6.603mm
10	Site 1468 Surface	6.21	6.16mm	6.20mm	6.67mm	6.310mm
11	Site 1468 Surface	4.94	5.15mm	5.26mm	5.08mm	5.108mm
12	Site 1468 Surface	4.17	5.06mm	5.52mm	4.94mm	4.923mm
13	Site 1468 Surface	5.08	5.17mm	4.84mm	4.91mm	5.000mm
14	Site 1468 Surface	4.89	4.48mm	4.05mm	4.45mm	4.468mm
15	Site 1468 Surface	5.7	5.40mm	5.06mm	5.25mm	5.353mm
16	Site 1468 Surface	5.73	5.56mm	5.83mm	5.83mm	5.737mm
17	Site 1468 Surface	4.55	4.69mm	4.66mm	4.42mm	4.580mm
18	Site 1468 Surface	4.26	4.62mm	4.32mm	4.29mm	4.373mm
19	Site 1468 Surface	5.9	5.37mm	5.83mm	5.68mm	5.695mm
20	Site 1468 Surface	4.15	4.36mm	4.22mm	4.19mm	4.230mm
21	Site 1468 Surface	5.23	5.00mm	4.57mm	4.69mm	4.873mm
22	Site 1468 Surface	4.87	5.16mm	5.08mm	5.06mm	5.043mm
23	Site 1468 Surface	5.11	6.04mm	5.43mm	5.07mm	5.413mm
24	Site 1468 Surface	5.73	4.64mm	4.73mm	4.42mm	4.880mm
25	Site 1468 Surface	4.53	4.95mm	5.03mm	5.01mm	4.880mm
26	Site 1468 Surface	5.43	4.17mm	5.21mm	5.46mm	5.068mm
27	Site 1468 Surface	5.64	5.59mm	5.88mm	5.91mm	5.755mm
28	Site 1468 Surface	5.56	5.28mm	4.97mm	4.73mm	5.135mm
29	Site 1468 Surface	3.89	5.92mm	5.71mm	6.23mm	5.438mm
30	Site 1468 Surface	5.06	5.16mm	4.18mm	4.24mm	4.660mm
31	Site 1468 Surface	5.88	5.56mm	5.97mm	5.87mm	5.820mm
32	Site 1468 Surface	5.27	5.60mm	6.19mm	5.64mm	5.675mm
33	Site 1468 Surface	5.15	4.74mm	5.64mm	4.66mm	5.048mm
34	Site 1468 Surface	6.02	5.74mm	6.55mm	6.89mm	6.300mm
35	Site 1468 Surface	5.09	4.49mm	4.33mm	4.77mm	4.670mm
36	Site 1468 Surface	4.19	4.51mm	2.31mm	3.39mm	3.600mm
37	Site 1468 Surface	4.53	4.82mm	4.15mm	4.55mm	4.513mm
38	Site 1468 Surface	6.21	7.14mm	6.23mm	6.04mm	6.405mm
39	Site 1468 Surface	4.9	4.76mm	4.02mm	4.68mm	4.590mm
40	Site 1468 Surface	4.64	5.33mm	4.62mm	4.48mm	4.768mm

Table B.4 continued. Site 03070101468 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
41	Site 1468 Surface	5.23	5.14mm	5.16mm	5.23mm	5.190mm
42	Site 1468 Surface	5.34	5.00mm	4.78mm	4.78mm	4.975mm
43	Site 1468 Surface	7.29	6.40mm	6.98mm	7.00mm	6.918mm
44	Site 1468 Surface	5.46	4.87mm	4.35mm	4.22mm	4.725mm
45	Site 1468 Surface	4.84	5.12mm	4.51mm	4.46mm	4.733mm
46	Site 1468 Surface	7.44	4.60mm	6.10mm	6.78mm	6.230mm
47	Site 1468 Surface	5.41	5.43mm	5.13mm	4.51mm	5.120mm

		Date Estimate with 1 sigma Error		
Mean Site Thickness	5.303mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 1057	A.D. 1103	A.D. 1149
Quadratic Reggression		A.D. 1067	A.D. 1109	A.D. 1151

Table B.5. Site 03070102443 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 2433 Surface	7.10mm	7.50mm	7.30mm	7.30mm	7.300mm
2	Site 2433 Surface	2.90mm	2.90mm	2.70mm	2.70mm	2.800mm
3	Site 2433 Surface	4.10mm	4.70mm	4.90mm	5.20mm	4.725mm
4	Site 2433 Surface	4.80mm	4.90mm	4.60mm	4.70mm	4.750mm
5	Site 2433 Surface	4.20mm	4.70mm	-	-	4.450mm
6	Site 2433 Surface	4.10mm	4.50mm	4.50mm	4.10mm	4.300mm
7	Site 2433 Surface	5.20mm	-	-	-	5.200mm
8	Site 2433 Surface	4.60mm	4.80mm	5.00mm	4.80mm	4.800mm
9	Site 2433 Surface	4.30mm	4.30mm	-	-	4.300mm
10	Site 2433 Surface	4.30mm	4.00mm	4.20mm	-	4.167mm
11	Site 2433 Surface	5.30mm	5.10mm	4.90mm	5.20mm	5.125mm
12	Site 2433 Surface	4.60mm	4.80mm	4.40mm	4.00mm	4.450mm
13	Site 2433 Surface	5.40mm	5.00mm	5.20mm	5.50mm	5.275mm
14	Site 2433 Surface	5.30mm	5.70mm	5.30mm	6.40mm	5.675mm
15	Site 2433 Surface	4.30mm	4.40mm	4.20mm	4.50mm	4.350mm
16	Site 2433 Surface	5.10mm	5.10mm	5.20mm	4.70mm	5.025mm
17	Site 2433 Surface	5.60mm	5.30mm	4.40mm	4.70mm	5.000mm
18	Site 2433 Surface	3.90mm	4.00mm	3.90mm	4.20mm	4.000mm
19	Site 2433 Surface	3.50mm	3.40mm	3.40mm	-	3.433mm
20	Site 2433 Surface	9.80mm	3.80mm	3.70mm	3.80mm	5.275mm
21	Site 2433 Surface	5.70mm	5.20mm	4.90mm	4.80mm	5.150mm
22	Site 2433 Surface	5.70mm	5.70mm	5.60mm	5.00mm	5.500mm
23	Site 2433 Surface	4.50mm	4.20mm	4.90mm	5.40mm	4.750mm
24	Site 2433 Surface	5.00mm	4.10mm	3.90mm	3.80mm	4.200mm
25	Site 2433 Surface	4.70mm	4.00mm	3.20mm	3.30mm	3.800mm
26	Site 2433 Surface	5.50mm	5.47mm	5.60mm	5.40mm	5.493mm
27	Site 2433 Surface	4.40mm	4.40mm	4.30mm	-	4.367mm
28	Site 2433 Surface	4.30mm	4.40mm	4.20mm	3.50mm	4.100mm
29	Site 2433 Surface	3.60mm	3.10mm	3.70mm	-	3.467mm
30	Site 2433 Surface	4.70mm	4.40mm	4.20mm	4.80mm	4.525mm
31	Site 2433 Surface	5.30mm	5.20mm	5.00mm	5.10mm	5.150mm
32	Site 2433 Surface	5.20mm	5.20mm	5.20mm	5.10mm	5.175mm
33	Site 2433 Surface	4.10mm	4.10mm	4.30mm	4.00mm	4.125mm

		Date Estimate with 1 sigma Error		
Mean Site Thickness	4.673mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 905	A.D. 951	A.D. 997
Quadratic Reggression		A.D. 919	A.D. 961	A.D. 1003

Table B.6. Site 03070102774 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 2774 surface	6.50mm	6.90mm	6.50mm	6.50mm	6.600mm
2	Site 2774 surface	4.80mm	4.60mm	4.80mm	5.50mm	4.925mm
3	Site 2774 surface	5.30mm	5.70mm	5.80mm	5.10mm	5.475mm
4	Site 2774 surface	5.80mm	5.50mm	5.20mm	5.40mm	5.475mm
5	Site 2774 surface	5.80mm	6.60mm	5.10mm	5.60mm	5.775mm
6	Site 2774 surface	4.70mm	4.30mm	4.80mm	4.90mm	4.675mm
7	Site 2774 surface	4.90mm	5.00mm	5.00mm	5.10mm	5.000mm
8	Site 2774 surface	4.90mm	4.90mm	5.10mm	4.70mm	4.900mm
9	Site 2774 surface	6.50mm	7.70mm	7.20mm	7.00mm	7.100mm
10	Site 2774 surface	4.70mm	5.10mm	4.70mm	5.50mm	5.000mm
11	Site 2774 surface	5.70mm	5.10mm	-	-	5.400mm
12	Site 2774 surface	5.20mm	5.20mm	4.90mm	4.70mm	5.000mm
13	Site 2774 surface	6.60mm	7.80mm	8.10mm	-	7.500mm
14	Site 2774 surface	3.80mm	4.70mm	4.40mm	3.90mm	4.200mm
15	Site 2774 surface	6.00mm	5.80mm	5.60mm	6.60mm	6.000mm
16	Site 2774 surface	3.90mm	3.70mm	3.90mm	4.20mm	3.925mm
17	Site 2774 surface	5.50mm	5.20mm	5.40mm	5.40mm	5.375mm
18	Site 2774 surface	4.20mm	5.10mm	5.30mm	4.90mm	4.875mm
19	Site 2774 surface	6.20mm	6.20mm	5.70mm	5.50mm	5.900mm
20	Site 2774 surface	4.60mm	5.00mm	5.30mm	4.50mm	4.850mm
21	Site 2774 surface	5.20mm	4.70mm	5.30mm	4.90mm	5.025mm
22	Site 2774 surface	5.90mm	5.70mm	5.40mm	6.00mm	5.750mm
23	Site 2774 surface	3.60mm	3.90mm	4.40mm	3.40mm	3.825mm
24	Site 2774 surface	5.90mm	6.10mm	6.30mm	6.20mm	6.125mm
25	Site 2774 surface	5.40mm	5.50mm	5.30mm	5.50mm	5.425mm
26	Site 2774 surface	5.80mm	6.00mm	5.80mm	5.70mm	5.825mm
27	Site 2774 surface	5.50mm	4.80mm	5.50mm	5.50mm	5.325mm
28	Site 2774 surface	5.00mm	4.60mm	4.90mm	4.90mm	4.850mm
29	Site 2774 surface	5.30mm	5.60mm	6.00mm	5.80mm	5.675mm
30	Site 2774 surface	4.20mm	4.50mm	4.80mm	4.60mm	4.525mm
31	Site 2774 surface	5.90mm	6.00mm	5.80mm	5.60mm	5.825mm
32	Site 2774 surface	4.40mm	5.40mm	5.00mm	4.80mm	4.900mm
33	Site 2774 Surface	4.80mm	5.10mm	5.20mm	5.00mm	5.025mm

		Date Estimate with 1 sigma Error		
Mean Site Thickness	5.335mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 1065	A.D. 1111	A.D. 1157
Quadratic Reggression		A.D. 1072	A.D. 1114	A.D. 1156

Table B.7. Site 03070102775 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 2775 Surface	6.60mm	6.60mm	6.50mm	6.00mm	6.425mm
2	Site 2775 Surface	4.80mm	4.30mm	4.20mm	4.60mm	4.475mm
3	Site 2775 Surface	4.80mm	5.00mm	4.80mm	4.90mm	4.875mm
4	Site 2775 Surface	5.50mm	6.50mm	5.10mm	4.90mm	5.500mm
5	Site 2775 Surface	3.90mm	3.90mm	3.50mm	3.90mm	3.800mm
6	Site 2775 Surface	5.20mm	5.10mm	5.20mm	5.30mm	5.200mm
7	Site 2775 Surface	5.80mm	5.50mm	5.90mm	5.90mm	5.775mm
8	Site 2775 Surface	5.10mm	5.60mm	5.80mm	5.80mm	5.575mm
9	Site 2775 Surface	6.70mm	6.80mm	6.70mm	6.50mm	6.675mm
10	Site 2775 Surface	5.80mm	6.50mm	5.50mm	6.50mm	6.075mm
11	Site 2775 Surface	5.90mm	5.60mm	5.80mm	6.20mm	5.875mm
12	Site 2775 Surface	5.20mm	4.60mm	5.40mm	5.50mm	5.175mm
13	Site 2775 Surface	7.00mm	6.30mm	6.00mm	6.70mm	6.500mm
14	Site 2775 Surface	4.40mm	5.00mm	5.30mm	5.00mm	4.925mm
15	Site 2775 Surface	5.60mm	6.00mm	6.20mm	5.70mm	5.875mm
16	Site 2775 Surface	5.50mm	5.70mm	5.80mm	5.30mm	5.575mm
17	Site 2775 Surface	5.20mm	4.90mm	4.60mm	4.90mm	4.900mm
18	Site 2775 Surface	6.10mm	6.60mm	6.30mm	6.10mm	6.275mm
19	Site 2775 Surface	5.20mm	6.10mm	6.00mm	5.30mm	5.650mm
20	Site 2775 Surface	7.00mm	6.50mm	6.30mm	6.80mm	6.650mm
21	Site 2775 Surface	4.10mm	4.60mm	4.80mm	3.90mm	4.350mm
22	Site 2775 Surface	4.20mm	4.40mm	4.20mm	4.70mm	4.375mm
23	Site 2775 Surface	6.10mm	6.50mm	7.00mm	6.10mm	6.425mm
24	Site 2775 Surface	5.00mm	6.90mm	6.00mm	6.20mm	6.025mm
25	Site 2775 Surface	5.40mm	5.60mm	5.30mm	5.40mm	5.425mm
26	Site 2775 Surface	5.30mm	5.60mm	6.00mm	5.90mm	5.700mm
27	Site 2775 Surface	4.20mm	5.70mm	6.40mm	5.20mm	5.375mm
28	Site 2775 Surface	4.10mm	4.10mm	4.50mm	4.50mm	4.300mm
29	Site 2775 Surface	5.90mm	6.20mm	5.80mm	5.50mm	5.850mm
30	Site 2775 Surface	5.80mm	5.80mm	5.00mm	5.70mm	5.575mm
31	Site 2775 Surface	5.80mm	5.30mm	5.90mm	6.40mm	5.850mm
32	Site 2775 Surface	5.20mm	5.10mm	4.90mm	5.20mm	5.100mm
33	Site 2775 Surface	4.40mm	4.50mm	4.70mm	4.40mm	4.500mm

		Date Estimate with 1 sigma Error		
Mean Site Thickness	5.473mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 1099	A.D. 1145	A.D. 1191
Quadratic Reggression		A.D. 1088	A.D. 1130	A.D. 1172

Table B.8. Site 03070102776 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 2776 F8 Surface	5.61mm	4.70mm	4.74mm	5.32mm	5.093mm
2	Site 2776 F8 Surface	5.80mm	5.17mm	6.47mm	6.95mm	6.098mm
3	Site 2776 F8 Surface	5.82mm	5.71mm	4.94mm	5.42mm	5.473mm
4	Site 2776 F8 Surface	6.37mm	6.51mm	7.04mm	6.94mm	6.715mm
5	Site 2776 F8 Surface	5.63mm	5.64mm	6.19mm	5.94mm	5.850mm
6	Site 2776 F8 Surface	5.73mm	6.50mm	6.27mm	5.93mm	6.108mm
7	Site 2776 F8 Surface	6.10mm	6.03mm	5.88mm	5.68mm	5.923mm
8	Site 2776 F8 Surface	5.26mm	4.76mm	5.12mm	5.39mm	5.133mm
9	Site 2776 F8 Surface	6.64mm	6.83mm	6.85mm	6.99mm	6.828mm
10	Site 2776 F8 Surface	4.09mm	4.46mm	4.67mm	4.21mm	4.358mm
11	Site 2776 F8 Surface	5.90mm	5.78mm	6.04mm	5.78mm	5.875mm
12	Site 2776 F8 Surface	5.78mm	6.05mm	6.66mm	6.49mm	6.245mm
13	Site 2776 F8 Surface	5.51mm	5.64mm	6.24mm	5.43mm	5.705mm
14	Site 2776 F8 Surface	4.32mm	4.52mm	4.44mm	3.98mm	4.315mm
15	Site 2776 F8 Surface	5.87mm	6.19mm	6.13mm	5.94mm	6.033mm
16	Site 2776 F8 Surface	5.11mm	5.16mm	5.17mm	5.17mm	5.153mm
17	Site 2776 F8 Surface	6.47mm	6.43mm	6.59mm	6.54mm	6.508mm
18	Site 2776 F8 Surface	5.52mm	5.28mm	4.96mm	5.43mm	5.298mm
19	Site 2776 F8 Surface	5.92mm	5.97mm	6.08mm	6.15mm	6.030mm
20	Site 2776 F8 Surface	4.36mm	4.43mm	4.66mm	4.42mm	4.468mm
21	Site 2776 F8 Surface	5.91mm	6.22mm	5.96mm	5.87mm	5.990mm
22	Site 2776 F8 Surface	5.69mm	5.17mm	6.11mm	5.57mm	5.635mm
23	Site 2776 F8 Surface	7.16mm	6.69mm	6.87mm	7.11mm	6.958mm
24	Site 2776 F8 Surface	5.40mm	5.34mm	5.48mm	5.64mm	5.465mm
25	Site 2776 F8 Surface	4.22mm	4.66mm	4.62mm	4.31mm	4.453mm
26	Site 2776 F8 Surface	5.18mm	5.93mm	5.12mm	5.50mm	5.433mm
27	Site 2776 F8 Surface	5.00mm	5.51mm	5.85mm	5.71mm	5.518mm
28	Site 2776 F8 Surface	7.15mm	7.54mm	6.67mm	6.52mm	6.970mm
29	Site 2776 F8 Surface	6.18mm	5.32mm	6.61mm	6.34mm	6.113mm
30	Site 2776 F8 Surface	5.25mm	5.00mm	4.87mm	5.09mm	5.053mm
31	Site 2776 F8 Surface	5.52mm	5.52mm	5.32mm	5.46mm	5.455mm
32	Site 2776 F8 Surface	6.01mm	6.19mm	5.83mm	5.89mm	5.980mm
33	Site 2776 F8 Surface	4.85mm	4.74mm	4.49mm	4.53mm	4.653mm

		Date Estimate with 1 sigma Error		
Mean Site Thickness	5.663mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 1144	A.D. 1190	A.D. 1236
Quadratic Reggression		A.D. 1103	A.D. 1145	A.D. 1187

Table B.9. Site 03070102778 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 2778 Surface	4.70mm	5.50mm	5.30mm	5.00mm	5.125mm
2	Site 2778 Surface	4.80mm	6.00mm	5.90mm	5.20mm	5.475mm
3	Site 2778 Surface	4.40mm	5.90mm	6.00mm	5.20mm	5.375mm
4	Site 2778 Surface	4.40mm	4.60mm	4.70mm	4.20mm	4.475mm
5	Site 2778 Surface	6.20mm	5.10mm	5.60mm	6.20mm	5.775mm
6	Site 2778 Surface	3.40mm	3.20mm	3.60mm	4.50mm	3.675mm
7	Site 2778 Surface	4.50mm	4.30mm	4.10mm	4.20mm	4.275mm
8	Site 2778 Surface	4.20mm	4.30mm	4.70mm	4.60mm	4.450mm
9	Site 2778 Surface	5.50mm	5.70mm	6.10mm	5.90mm	5.800mm
10	Site 2778 Surface	5.10mm	4.70mm	5.30mm	4.90mm	5.000mm
11	Site 2778 Surface	4.80mm	4.50mm	4.00mm	-	4.433mm
12	Site 2778 Surface	5.60mm	6.20mm	5.30mm	-	5.700mm
13	Site 2778 Surface	5.20mm	4.60mm	4.70mm	4.80mm	4.825mm
14	Site 2778 Surface	5.90mm	5.30mm	5.70mm	5.80mm	5.675mm
15	Site 2778 Surface	6.30mm	6.10mm	6.50mm	6.40mm	6.325mm
16	Site 2778 Surface	5.10mm	4.90mm	6.40mm	6.00mm	5.600mm
17	Site 2778 Surface	6.90mm	7.00mm	7.00mm	6.30mm	6.800mm
18	Site 2778 Surface	4.60mm	4.50mm	5.20mm	4.90mm	4.800mm
19	Site 2778 Surface	4.50mm	4.60mm	5.20mm	4.90mm	4.800mm
20	Site 2778 Surface	5.30mm	6.00mm	5.60mm	5.40mm	5.575mm
21	Site 2778 Surface	6.50mm	7.00mm	6.10mm	5.30mm	6.225mm
22	Site 2778 Surface	7.40mm	7.60mm	7.70mm	7.00mm	7.425mm
23	Site 2778 Surface	5.00mm	4.70mm	5.10mm	5.40mm	5.050mm
24	Site 2778 Surface	4.20mm	5.40mm	5.70mm	4.80mm	5.025mm
25	Site 2778 Surface	5.90mm	6.00mm	6.00mm	5.30mm	5.800mm
26	Site 2778 Surface	5.50mm	6.00mm	6.30mm	6.00mm	5.950mm
27	Site 2778 Surface	4.90mm	5.30mm	5.20mm	4.80mm	5.050mm
28	Site 2778 Surface	4.70mm	6.30mm	4.90mm	5.60mm	5.375mm
29	Site 2778 Surface	4.30mm	4.40mm	4.20mm	4.40mm	4.325mm
30	Site 2778 Surface	3.70mm	3.90mm	3.90mm	3.90mm	3.850mm
31	Site 2778 Surface	5.00mm	5.40mm	5.30mm	5.10mm	5.200mm
32	Site 2778 Surface	5.30mm	5.10mm	5.60mm	4.90mm	5.225mm
33	Site 2778 Surface	4.70mm	4.30mm	4.60mm	4.80mm	4.600mm

		Date Estimate with 1 sigma Error		
Mean Site Thickness	5.244mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 1043	A.D. 1089	A.D. 1135
Quadratic Reggression		A.D. 1058	A.D. 1100	A.D. 1142

Table B.10. Site 03070102779 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 2779 Surface	6.30mm	6.60mm	7.20mm	6.10mm	6.550mm
2	Site 2779 Surface	4.80mm	5.20mm	5.20mm	5.00mm	5.050mm
3	Site 2779 Surface	4.30mm	4.40mm	4.50mm	3.90mm	4.275mm
4	Site 2779 Surface	4.30mm	4.60mm	4.30mm	4.40mm	4.400mm
5	Site 2779 Surface	5.60mm	6.00mm	5.00mm	5.40mm	5.500mm
6	Site 2779 Surface	5.70mm	5.30mm	5.20mm	5.30mm	5.375mm
7	Site 2779 Surface	6.10mm	5.90mm	6.10mm	5.70mm	5.950mm
8	Site 2779 Surface	5.70mm	5.90mm	6.00mm	6.40mm	6.000mm
9	Site 2779 Surface	5.80mm	7.30mm	6.60mm	6.20mm	6.475mm
10	Site 2779 Surface	4.60mm	4.20mm	3.30mm	4.30mm	4.100mm
11	Site 2779 Surface	5.10mm	6.50mm	6.10mm	5.70mm	5.850mm
12	Site 2779 Surface	4.30mm	4.80mm	5.40mm	4.90mm	4.850mm
13	Site 2779 Surface	4.90mm	4.60mm	4.40mm	5.00mm	4.725mm
14	Site 2779 Surface	5.30mm	5.40mm	5.50mm	4.90mm	5.275mm
15	Site 2779 Surface	4.50mm	5.90mm	4.20mm	4.90mm	4.875mm
16	Site 2779 Surface	6.20mm	6.10mm	5.70mm	6.20mm	6.050mm
17	Site 2779 Surface	4.30mm	4.80mm	4.70mm	4.40mm	4.550mm
18	Site 2779 Surface	5.10mm	4.20mm	4.60mm	5.20mm	4.775mm
19	Site 2779 Surface	5.70mm	5.60mm	5.10mm	5.20mm	5.400mm
20	Site 2779 Surface	5.20mm	4.90mm	5.00mm	5.10mm	5.050mm
21	Site 2779 Surface	5.40mm	5.80mm	5.60mm	5.40mm	5.550mm
22	Site 2779 Surface	6.70mm	6.80mm	6.90mm	6.80mm	6.800mm
23	Site 2779 Surface	4.90mm	4.60mm	4.30mm	5.10mm	4.725mm
24	Site 2779 Surface	4.30mm	4.70mm	4.60mm	4.40mm	4.500mm
25	Site 2779 Surface	4.70mm	5.20mm	4.80mm	4.80mm	4.875mm
26	Site 2779 Surface	5.60mm	4.80mm	5.20mm	5.40mm	5.250mm
27	Site 2779 Surface	3.80mm	4.20mm	3.50mm	3.70mm	3.800mm
28	Site 2779 Surface	5.20mm	5.40mm	5.60mm	5.00mm	5.300mm
29	Site 2779 Surface	5.10mm	4.90mm	4.90mm	4.90mm	4.950mm
30	Site 2779 Surface	4.40mm	4.40mm	4.30mm	4.50mm	4.400mm
31	Site 2779 Surface	4.70mm	4.60mm	4.60mm	4.10mm	4.500mm
32	Site 2779 Surface	4.80mm	4.80mm	4.00mm	4.70mm	4.575mm
33	Site 2779 Surface	4.30mm	5.50mm	4.60mm	4.80mm	4.800mm

		Date Estimate w/ 1 sigma Error		
Mean Site Thickness	5.124mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 1014	A.D. 1060	A.D. 1106
Quadratic Reggression		A.D. 1036	A.D. 1078	A.D. 1120

Table B.11. Site 03070102780 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 2780 Surface	5.40mm	5.70mm	6.00mm	6.10mm	5.800mm
2	Site 2780 Surface	5.30mm	4.90mm	4.80mm	4.90mm	4.975mm
3	Site 2780 Surface	4.50mm	4.10mm	4.40mm	4.50mm	4.375mm
4	Site 2780 Surface	6.00mm	6.30mm	5.80mm	5.60mm	5.925mm
5	Site 2780 Surface	5.20mm	5.30mm	5.50mm	5.50mm	5.375mm
6	Site 2780 Surface	6.50mm	7.50mm	7.80mm	7.60mm	7.350mm
7	Site 2780 Surface	4.80mm	5.40mm	5.50mm	4.80mm	5.125mm
8	Site 2780 Surface	4.90mm	5.50mm	5.70mm	5.90mm	5.500mm
9	Site 2780 Surface	5.00mm	4.10mm	4.40mm	5.00mm	4.625mm
10	Site 2780 Surface	4.90mm	4.70mm	4.70mm	5.00mm	4.825mm
11	Site 2780 Surface	5.10mm	5.10mm	5.00mm	5.40mm	5.150mm
12	Site 2780 Surface	6.20mm	5.90mm	5.50mm	6.10mm	5.925mm
13	Site 2780 Surface	4.90mm	4.60mm	4.40mm	4.70mm	4.650mm
14	Site 2780 Surface	4.60mm	4.10mm	3.90mm	3.80mm	4.100mm
15	Site 2780 Surface	5.10mm	4.90mm	4.30mm	5.10mm	4.850mm
16	Site 2780 Surface	4.80mm	4.60mm	4.60mm	4.70mm	4.675mm
17	Site 2780 Surface	6.20mm	6.10mm	6.30mm	6.50mm	6.275mm
18	Site 2780 Surface	4.60mm	3.90mm	3.80mm	4.80mm	4.275mm
19	Site 2780 Surface	5.40mm	5.20mm	5.80mm	5.30mm	5.425mm
20	Site 2780 Surface	4.50mm	4.70mm	4.90mm	4.80mm	4.725mm
21	Site 2780 Surface	4.70mm	4.90mm	5.40mm	5.30mm	5.075mm
22	Site 2780 Surface	5.20mm	4.80mm	5.10mm	5.20mm	5.075mm
23	Site 2780 Surface	6.00mm	5.50mm	5.40mm	5.70mm	5.650mm
24	Site 2780 Surface	5.10mm	5.00mm	5.30mm	5.30mm	5.175mm
25	Site 2780 Surface	5.50mm	5.70mm	5.90mm	5.70mm	5.700mm
26	Site 2780 Surface	5.20mm	4.90mm	4.60mm	-	4.900mm
27	Site 2780 Surface	5.90mm	6.00mm	6.30mm	6.10mm	6.075mm
28	Site 2780 Surface	4.70mm	4.50mm	5.20mm	4.80mm	4.800mm
29	Site 2780 Surface	4.70mm	4.40mm	4.90mm	4.70mm	4.675mm
30	Site 2780 Surface	4.60mm	4.70mm	4.80mm	4.30mm	4.600mm
31	Site 2780 Surface	5.90mm	6.20mm	6.10mm	5.80mm	6.000mm
32	Site 2780 Surface	6.70mm	6.90mm	6.60mm	6.40mm	6.650mm
33	Site 2780 Surface	5.60mm	5.70mm	5.50mm	6.10mm	5.725mm

		Date Estimate w/ 1 sigma Error		
Mean Site Thickness	5.273mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 1050	A.D. 1096	A.D. 1142
Quadratic Reggression		A.D. 1063	A.D. 1105	A.D. 1147

Table B.12. Site 03070102782 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 2782 Surface	4.61mm	4.87mm	4.51mm	4.69mm	4.670mm
2	Site 2782 Surface	4.86mm	4.87mm	4.79mm	4.82mm	4.835mm
3	Site 2782 Surface	4.94mm	4.68mm	4.60mm	4.97mm	4.798mm
4	Site 2782 Surface	4.40mm	4.54mm	4.51mm	4.37mm	4.455mm
5	Site 2782 Surface	4.99mm	4.77mm	4.50mm	4.85mm	4.778mm
6	Site 2782 Surface	5.50mm	5.21mm	5.18mm	5.90mm	5.448mm
7	Site 2782 Surface	5.73mm	5.73mm	5.79mm	5.16mm	5.603mm
8	Site 2782 Surface	5.65mm	-	-	-	5.650mm
9	Site 2782 Surface	4.52mm	4.21mm	4.20mm	4.46mm	4.348mm
10	Site 2782 Surface	5.01mm	4.98mm	4.76mm	5.13mm	4.970mm
11	Site 2782 Surface	4.59mm	4.50mm	4.08mm	4.48mm	4.413mm
12	Site 2782 Surface	4.30mm	4.30mm	4.61mm	3.94mm	4.288mm
13	Site 2782 Surface	4.55mm	4.15mm	3.98mm	4.52mm	4.300mm
14	Site 2782 Surface	4.19mm	4.22mm	4.34mm	4.31mm	4.265mm
15	-	-	-	-	-	-
16	-	-	-	-	-	-
17	-	-	-	-	-	-
18	-	-	-	-	-	-
19	-	-	-	-	-	-
20	-	-	-	-	-	-
21	-	-	-	-	-	-
22	-	-	-	-	-	-
23	-	-	-	-	-	-
24	-	-	-	-	-	-
25	-	-	-	-	-	-
26	-	-	-	-	-	-
27	-	-	-	-	-	-
28	-	-	-	-	-	-
29	-	-	-	-	-	-
30	-	-	-	-	-	-
31	-	-	-	-	-	-
32	-	-	-	-	-	-
33	-	-	-	-	-	-

		Date Estimate w/ 1 sigma Error		
Mean Site Thickness	4.773mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 929	A.D. 975	A.D. 1021
Quadratic Reggression		A.D. 949	A.D. 991	A.D. 1033

Table B.13. Site 03070102783 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 2783 Surface	5.60mm	6.00mm	5.60mm	5.30mm	5.625mm
2	Site 2783 Surface	5.60mm	5.20mm	5.40mm	5.00mm	5.300mm
3	Site 2783 Surface	4.90mm	4.90mm	4.50mm	5.20mm	4.875mm
4	Site 2783 Surface	4.60mm	5.10mm	5.30mm	4.60mm	4.900mm
5	Site 2783 Surface	5.30mm	5.70mm	5.50mm	5.20mm	5.425mm
6	Site 2783 Surface	5.40mm	5.10mm	5.70mm	4.90mm	5.275mm
7	Site 2783 Surface	6.10mm	5.90mm	6.30mm	6.40mm	6.175mm
8	Site 2783 Surface	5.00mm	5.40mm	5.50mm	5.20mm	5.275mm
9	Site 2783 Surface	5.40mm	6.10mm	6.70mm	5.60mm	5.950mm
10	Site 2783 Surface	5.90mm	6.40mm	5.60mm	4.50mm	5.600mm
11	Site 2783 Surface	5.40mm	5.70mm	5.60mm	5.00mm	5.425mm
12	Site 2783 Surface	4.60mm	5.00mm	5.00mm	5.10mm	4.925mm
13	Site 2783 Surface	4.10mm	3.50mm	3.80mm	3.80mm	3.800mm
14	Site 2783 Surface	4.30mm	4.80mm	4.80mm	4.50mm	4.600mm
15	Site 2783 Surface	4.80mm	5.30mm	5.20mm	4.90mm	5.050mm
16	Site 2783 Surface	4.20mm	3.90mm	4.00mm	4.20mm	4.075mm
17	Site 2783 Surface	5.80mm	6.80mm	6.20mm	6.00mm	6.200mm
18	Site 2783 Surface	4.50mm	4.10mm	4.20mm	4.60mm	4.350mm
19	Site 2783 Surface	4.40mm	5.20mm	5.70mm	5.40mm	5.175mm
20	Site 2783 Surface	5.00mm	5.10mm	5.20mm	5.10mm	5.100mm
21	Site 2783 Surface	4.40mm	4.30mm	4.40mm	4.50mm	4.400mm
22	Site 2783 Surface	4.80mm	5.00mm	4.80mm	4.40mm	4.750mm
23	Site 2783 Surface	3.20mm	3.50mm	4.40mm	4.30mm	3.850mm
24	Site 2783 Surface	4.80mm	4.90mm	5.00mm	4.90mm	4.900mm
25	Site 2783 Surface	4.90mm	5.00mm	5.10mm	5.10mm	5.025mm
26	Site 2783 Surface	4.40mm	4.00mm	4.40mm	5.00mm	4.450mm
27	Site 2783 Surface	3.80mm	3.90mm	3.90mm	3.80mm	3.850mm
28	Site 2783 Surface	5.30mm	5.20mm	5.20mm	4.90mm	5.150mm
29	Site 2783 Surface	5.20mm	5.00mm	4.40mm	4.30mm	4.725mm
30	Site 2783 Surface	4.20mm	4.60mm	4.70mm	4.30mm	4.450mm
31	Site 2783 Surface	4.70mm	4.70mm	4.60mm	4.40mm	4.600mm
32	Site 2783 Surface	4.80mm	4.80mm	4.70mm	4.80mm	4.775mm
33	Site 2783 Surface	5.50mm	5.40mm	5.70mm	5.70mm	5.575mm

		Date Estimate w/ 1 sigma Error		
Mean Site Thickness	4.958mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 974	A.D. 1020	A.D. 1066
Quadratic Reggression		A.D. 999	A.D. 1041	A.D. 1083

Table B.14. Site 03070102784 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 2784 Surface	5.30mm	6.10mm	5.80mm	6.00mm	5.800mm
2	Site 2784 Surface	4.70mm	4.50mm	4.80mm	4.90mm	4.725mm
3	Site 2784 Surface	6.10mm	5.90mm	5.00mm	5.60mm	5.650mm
4	Site 2784 Surface	4.90mm	5.20mm	5.10mm	4.70mm	4.975mm
5	Site 2784 Surface	5.20mm	4.90mm	5.30mm	5.20mm	5.150mm
6	Site 2784 Surface	4.80mm	5.60mm	5.20mm	4.80mm	5.100mm
7	Site 2784 Surface	6.30mm	6.20mm	6.60mm	6.00mm	6.275mm
8	Site 2784 Surface	5.20mm	5.50mm	4.80mm	5.10mm	5.150mm
9	Site 2784 Surface	5.30mm	5.30mm	5.90mm	5.10mm	5.400mm
10	Site 2784 Surface	5.50mm	5.00mm	5.60mm	5.70mm	5.450mm
11	Site 2784 Surface	5.60mm	5.20mm	5.30mm	6.00mm	5.525mm
12	Site 2784 Surface	6.20mm	5.30mm	5.50mm	6.40mm	5.850mm
13	Site 2784 Surface	6.40mm	6.50mm	6.20mm	6.70mm	6.450mm
14	Site 2784 Surface	5.30mm	5.70mm	5.20mm	5.30mm	5.375mm
15	Site 2784 Surface	4.20mm	4.50mm	4.30mm	4.30mm	4.325mm
16	Site 2784 Surface	4.00mm	4.40mm	4.60mm	4.60mm	4.400mm
17	Site 2784 Surface	3.80mm	3.80mm	3.50mm	3.60mm	3.675mm
18	Site 2784 Surface	4.80mm	4.00mm	4.30mm	4.60mm	4.425mm
19	Site 2784 Surface	4.90mm	4.80mm	5.10mm	5.10mm	4.975mm
20	Site 2784 Surface	4.40mm	4.30mm	4.40mm	4.30mm	4.350mm
21	Site 2784 Surface	5.50mm	5.40mm	4.90mm	4.40mm	5.050mm
22	Site 2784 Surface	4.40mm	4.40mm	4.20mm	4.10mm	4.275mm
23	Site 2784 Surface	3.90mm	3.60mm	3.70mm	4.00mm	3.800mm
24	Site 2784 Surface	5.30mm	5.80mm	6.00mm	5.70mm	5.700mm
25	Site 2784 Surface	3.70mm	3.70mm	3.40mm	3.70mm	3.625mm
26	Site 2784 Surface	4.40mm	4.00mm	4.50mm	4.30mm	4.300mm
27	Site 2784 Surface	3.90mm	4.00mm	4.50mm	4.00mm	4.100mm
28	Site 2784 Surface	4.50mm	4.10mm	3.60mm	3.80mm	4.000mm
29	Site 2784 Surface	4.40mm	4.40mm	4.00mm	4.40mm	4.300mm
30	Site 2784 Surface	2.70mm	3.70mm	4.50mm	4.60mm	3.875mm
31	Site 2784 Surface	4.20mm	3.60mm	3.70mm	3.80mm	3.825mm
32	Site 2784 Surface	3.10mm	2.90mm	3.20mm	3.40mm	3.150mm
33	Site 2784 Surface	4.20mm	4.10mm	4.70mm	4.60mm	4.400mm

		Date Estimate w/ 1 sigma Error		
Mean Site Thickness	4.770mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 929	A.D. 975	A.D. 1021
Quadratic Reggression		A.D. 949	A.D. 991	A.D. 1033

Table B.15. Site 03070102786 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 2786 Surface	4.30mm	4.00mm	3.80mm	4.70mm	4.200mm
2	Site 2786 Surface	3.50mm	3.40mm	3.80mm	3.60mm	3.575mm
3	Site 2786 Surface	4.70mm	5.00mm	5.00mm	4.90mm	4.900mm
4	Site 2786 Surface	5.70mm	6.00mm	5.80mm	5.90mm	5.850mm
5	Site 2786 Surface	4.50mm	4.90mm	4.10mm	4.30mm	4.450mm
6	Site 2786 Surface	6.20mm	6.20mm	5.90mm	6.10mm	6.100mm
7	Site 2786 Surface	6.00mm	6.00mm	6.40mm	5.90mm	6.075mm
8	Site 2786 Surface	5.00mm	4.90mm	5.30mm	5.40mm	5.150mm
9	Site 2786 Surface	3.60mm	3.10mm	3.50mm	3.90mm	3.525mm
10	Site 2786 Surface	6.30mm	6.40mm	6.30mm	6.20mm	6.300mm
11	Site 2786 Surface	6.00mm	6.00mm	5.80mm	6.10mm	5.975mm
12	Site 2786 Surface	4.40mm	3.80mm	4.10mm	4.40mm	4.175mm
13	Site 2786 Surface	6.10mm	6.90mm	6.60mm	5.40mm	6.250mm
14	Site 2786 Surface	5.30mm	4.80mm	5.40mm	5.80mm	5.325mm
15	Site 2786 Surface	5.20mm	5.20mm	5.30mm	5.30mm	5.250mm
16	Site 2786 Surface	5.10mm	5.20mm	5.60mm	4.90mm	5.200mm
17	Site 2786 Surface	6.40mm	6.40mm	6.60mm	6.60mm	6.500mm
18	Site 2786 Surface	4.50mm	4.50mm	4.60mm	4.40mm	4.500mm
19	Site 2786 Surface	3.70mm	3.90mm	4.00mm	3.90mm	3.875mm
20	Site 2786 Surface	4.70mm	5.20mm	4.30mm	4.40mm	4.650mm
21	Site 2786 Surface	4.30mm	4.60mm	4.40mm	4.30mm	4.400mm
22	Site 2786 Surface	4.10mm	3.80mm	3.90mm	4.10mm	3.975mm
23	Site 2786 Surface	3.80mm	3.60mm	3.60mm	4.00mm	3.750mm
24	Site 2786 Surface	3.90mm	4.00mm	3.40mm	3.00mm	3.575mm
25	Site 2786 Surface	3.60mm	3.30mm	2.80mm	2.90mm	3.150mm
26	Site 2786 Surface	4.40mm	4.50mm	4.50mm	4.30mm	4.425mm
27	Site 2786 Surface	5.70mm	5.50mm	5.30mm	5.30mm	5.450mm
28	Site 2786 Surface	5.00mm	5.50mm	5.40mm	5.60mm	5.375mm
29	Site 2786 Surface	5.20mm	4.90mm	5.10mm	5.20mm	5.100mm
30	Site 2786 Surface	4.60mm	4.70mm	4.40mm	4.50mm	4.550mm
31	Site 2786 Surface	4.10mm	4.50mm	4.10mm	4.10mm	4.200mm
32	Site 2786 Surface	4.70mm	5.00mm	5.40mm	5.20mm	5.075mm
33	Site 2786 Surface	6.30mm	5.90mm	5.10mm	5.20mm	5.625mm

		Date Estimate w/ 1 sigma Error		
Mean Site Thickness	4.863mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 951	A.D. 997	A.D. 1043
Quadratic Reggression		A.D. 975	A.D. 1017	A.D. 1059

Table B.16. Site 03070102788 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 2788 Surface	5.00mm	4.90mm	4.90mm	5.00mm	4.950mm
2	Site 2788 Surface	4.20mm	5.40mm	5.30mm	4.20mm	4.775mm
3	Site 2788 Surface	6.90mm	6.00mm	6.90mm	7.10mm	6.725mm
4	Site 2788 Surface	6.70mm	6.10mm	6.70mm	7.00mm	6.625mm
5	Site 2788 Surface	4.40mm	4.90mm	4.70mm	4.80mm	4.700mm
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
11	-	-	-	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	-	-	-	-	-	-
15	-	-	-	-	-	-
16	-	-	-	-	-	-
17	-	-	-	-	-	-
18	-	-	-	-	-	-
19	-	-	-	-	-	-
20	-	-	-	-	-	-
21	-	-	-	-	-	-
22	-	-	-	-	-	-
23	-	-	-	-	-	-
24	-	-	-	-	-	-
25	-	-	-	-	-	-
26	-	-	-	-	-	-
27	-	-	-	-	-	-
28	-	-	-	-	-	-
29	-	-	-	-	-	-
30	-	-	-	-	-	-
31	-	-	-	-	-	-
32	-	-	-	-	-	-
33	-	-	-	-	-	-

		Date Estimate w/ 1 sigma Error		
Mean Site Thickness	5.555mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 1118	A.D. 1164	A.D. 1210
Quadratic Reggression		A.D. 1096	A.D. 1138	A.D. 1180

Table B.17. Site 03070102792 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 2792 Surface	4.87mm	5.09mm	4.99mm	5.11mm	5.015mm
2	Site 2792 Surface	4.93mm	5.61mm	4.89mm	4.56mm	4.998mm
3	Site 2792 Surface	4.91mm	5.01mm	4.68mm	4.55mm	4.788mm
4	Site 2792 Surface	5.81mm	5.52mm	5.74mm	5.58mm	5.663mm
5	Site 2792 Surface	5.51mm	5.45mm	5.98mm	5.69mm	5.658mm
6	Site 2792 Surface	3.81mm	4.37mm	4.80mm	5.03mm	4.503mm
7	Site 2792 Surface	5.87mm	5.79mm	5.57mm	5.76mm	5.748mm
8	Site 2792 Surface	5.35mm	6.09mm	6.25mm	6.04mm	5.933mm
9	Site 2792 Surface	5.32mm	5.51mm	5.40mm	5.38mm	5.403mm
10	Site 2792 Surface	4.60mm	4.61mm	4.76mm	4.75mm	4.680mm
11	Site 2792 Surface	7.10mm	6.60mm	5.29mm	5.26mm	6.063mm
12	Site 2792 Surface	3.50mm	3.89mm	4.45mm	4.19mm	4.008mm
13	Site 2792 Surface	5.30mm	5.48mm	5.57mm	5.62mm	5.493mm
14	Site 2792 Surface	5.62mm	5.45mm	5.25mm	5.45mm	5.443mm
15	Site 2792 Surface	5.20mm	4.54mm	4.92mm	5.46mm	5.030mm
16	Site 2792 Surface	6.15mm	5.83mm	5.82mm	5.96mm	5.940mm
17	Site 2792 Surface	5.79mm	5.84mm	4.92mm	6.02mm	5.643mm
18	Site 2792 Surface	5.48mm	5.29mm	6.10mm	5.89mm	5.690mm
19	Site 2792 Surface	5.13mm	5.38mm	5.27mm	5.47mm	5.313mm
20	Site 2792 Surface	4.85mm	5.19mm	4.82mm	4.30mm	4.790mm
21	Site 2792 Surface	6.45mm	5.90mm	5.53mm	5.71mm	5.898mm
22	Site 2792 Surface	4.71mm	5.22mm	5.24mm	5.15mm	5.080mm
23	Site 2792 Surface	5.50mm	5.19mm	5.53mm	6.16mm	5.595mm
24	Site 2792 Surface	6.96mm	6.69mm	6.57mm	6.92mm	6.785mm
25	Site 2792 Surface	6.75mm	7.13mm	6.46mm	5.41mm	6.438mm
26	Site 2792 Surface	5.22mm	6.40mm	4.96mm	4.57mm	5.288mm
27	Site 2792 Surface	6.60mm	6.23mm	6.55mm	6.48mm	6.465mm
28	Site 2792 Surface	4.48mm	4.60mm	4.53mm	4.52mm	4.533mm
29	Site 2792 Surface	5.34mm	4.40mm	4.73mm	4.41mm	4.720mm
30	Site 2792 Surface	6.38mm	6.10mm	6.25mm	6.20mm	6.233mm
31	Site 2792 Surface	5.22mm	5.84mm	5.22mm	5.63mm	5.478mm
32	Site 2792 Surface	6.07mm	5.95mm	5.43mm	5.40mm	5.713mm
33	Site 2792 Surface	6.36mm	6.06mm	6.03mm	6.22mm	6.168mm
34	Site 2792 Surface	5.91mm	5.54mm	6.03mm	5.95mm	5.858mm
35	Site 2792 Surface	6.06mm	5.55mm	5.58mm	5.83mm	5.755mm
36	Site 2792 Surface	6.16mm	6.41mm	6.53mm	6.52mm	6.405mm
37	Site 2792 Surface	5.83mm	6.12mm	6.21mm	5.94mm	6.025mm
38	Site 2792 Surface	5.26mm	4.99mm	5.19mm	5.32mm	5.190mm
39	Site 2792 Surface	5.26mm	4.76mm	5.46mm	5.26mm	5.185mm
40	Site 2792 Surface	6.53mm	6.32mm	5.84mm	6.01mm	6.175mm

Table B.17 continued. Site 03070102792 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
41	Site 2792 Surface	5.98mm	6.02mm	6.54mm	6.35mm	6.223mm
42	Site 2792 Surface	6.59mm	6.79mm	6.74mm	6.58mm	6.675mm

		Date Estimate w/ 1 sigma Error		
Mean Site Thickness	5.564mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 1120	A.D. 1166	A.D. 1212
Quadratic Reggression		A.D. 1097	A.D. 1139	A.D. 1181

Table B.18. Site 03070102793 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 2793 Surface	5.22mm	5.42mm	5.87mm	5.55mm	5.515mm
2	Site 2793 Surface	6.75mm	6.65mm	6.81mm	6.87mm	6.770mm
3	Site 2793 Surface	6.28mm	6.41mm	5.82mm	5.65mm	6.040mm
4	Site 2793 Surface	6.71mm	6.61mm	7.09mm	7.09mm	6.875mm
5	Site 2793 Surface	5.62mm	4.96mm	5.23mm	5.98mm	5.448mm
6	Site 2793 Surface	4.32mm	4.07mm	3.92mm	4.51mm	4.205mm
7	Site 2793 Surface	5.15mm	5.52mm	5.70mm	5.84mm	5.553mm
8	Site 2793 Surface	5.81mm	6.26mm	5.70mm	6.06mm	5.958mm
9	Site 2793 Surface	6.37mm	7.07mm	6.45mm	6.07mm	6.490mm
10	Site 2793 Surface	4.94mm	5.21mm	4.59mm	4.44mm	4.795mm
11	Site 2793 Surface	8.26mm	9.01mm	7.83mm	7.62mm	8.180mm
12	Site 2793 Surface	4.98mm	5.15mm	5.49mm	5.41mm	5.258mm
13	Site 2793 Surface	5.36mm	4.60mm	5.31mm	5.38mm	5.163mm
14	Site 2793 Surface	4.41mm	5.13mm	5.19mm	5.04mm	4.943mm
15	Site 2793 Surface	4.81mm	5.28mm	5.80mm	6.05mm	5.485mm
16	Site 2793 Surface	5.17mm	5.39mm	5.33mm	5.16mm	5.263mm
17	Site 2793 Surface	5.23mm	5.89mm	5.38mm	5.45mm	5.488mm
18	Site 2793 Surface	5.21mm	5.56mm	5.67mm	5.27mm	5.428mm
19	Site 2793 Surface	5.28mm	4.97mm	4.78mm	4.79mm	4.955mm
20	Site 2793 Surface	5.52mm	5.43mm	5.44mm	5.28mm	5.418mm
21	Site 2793 Surface	4.42mm	6.12mm	4.76mm	4.78mm	5.020mm
22	Site 2793 Surface	5.46mm	5.40mm	5.54mm	5.76mm	5.540mm
23	Site 2793 Surface	6.20mm	6.57mm	6.34mm	6.07mm	6.295mm
24	Site 2793 Surface	4.48mm	4.63mm	4.85mm	4.69mm	4.663mm
25	Site 2793 Surface	5.56mm	5.55mm	5.47mm	5.27mm	5.463mm
26	Site 2793 Surface	5.51mm	5.48mm	4.13mm	4.67mm	4.948mm
27	Site 2793 Surface	5.19mm	5.20mm	5.03mm	5.20mm	5.155mm
28	Site 2793 Surface	5.85mm	6.22mm	6.24mm	6.19mm	6.125mm
29	Site 2793 Surface	5.25mm	4.65mm	4.82mm	5.33mm	5.013mm
30	Site 2793 Surface	4.97mm	5.85mm	5.78mm	4.91mm	5.378mm
31	Site 2793 Surface	5.82mm	5.75mm	5.69mm	6.12mm	5.845mm
32	Site 2793 Surface	4.38mm	4.56mm	4.11mm	4.18mm	4.308mm
33	Site 2793 Surface	5.01mm	5.52mm	5.35mm	4.28mm	5.040mm
34	Site 2793 Surface	6.20mm	3.97mm	6.23mm	6.77mm	5.793mm
35	Site 2793 Surface	5.85mm	5.85mm	5.86mm	5.89mm	5.863mm
36	Site 2793 Surface	5.79mm	6.28mm	6.60mm	6.60mm	6.318mm
37	Site 2793 Surface	5.91mm	5.87mm	6.39mm	5.68mm	5.963mm
38	Site 2793 Surface	5.31mm	5.36mm	5.88mm	5.44mm	5.498mm
39	Site 2793 Surface	4.15mm	4.17mm	4.35mm	4.69mm	4.340mm
40	Site 2793 Surface	4.48mm	4.24mm	4.42mm	4.43mm	4.393mm

Table B.18 continued. Site 03070100238 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
41	Site 2793 Surface	5.88mm	6.00mm	6.00mm	5.89mm	5.943mm
42	Site 2793 Surface	4.38mm	3.94mm	4.32mm	4.43mm	4.268mm
43	Site 2793 Surface	6.40mm	6.43mm	6.25mm	6.22mm	6.325mm
44	Site 2793 Surface	5.32mm	5.45mm	5.30mm	5.41mm	5.370mm
45	Site 2793 Surface	5.03mm	5.16mm	5.51mm	5.20mm	5.225mm
46	Site 2793 Surface	5.92mm	6.03mm	6.19mm	6.14mm	6.070mm
47	Site 2793 Surface	5.32mm	5.09mm	4.17mm	4.91mm	4.873mm
48	Site 2793 Surface	6.15mm	5.70mm	5.36mm	5.99mm	5.800mm
49	Site 2793 Surface	6.34mm	6.09mm	5.55mm	5.51mm	5.873mm
50	Site 2793 Surface	4.17mm	5.59mm	5.61mm	5.45mm	5.205mm

		Date Estimate w/ 1 sigma Error		
Mean Site Thickness	5.503mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 1106	A.D. 1152	A.D. 1198
Quadratic Reggression		A.D. 1091	A.D. 1133	A.D. 1175

Table B.19. Site 03070102795 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 2795 Surface	6.80mm	5.60mm	5.70mm	5.90mm	6.000mm
2	Site 2795 Surface	5.80mm	5.20mm	5.70mm	5.80mm	5.625mm
3	Site 2795 Surface	4.90mm	4.20mm	4.80mm	-	4.633mm
4	Site 2795 Surface	4.50mm	4.60mm	4.30mm	-	4.467mm
5	Site 2795 Surface	4.70mm	4.40mm	-	-	4.550mm
6	Site 2795 Surface	5.80mm	-	-	-	5.800mm
7	Site 2795 Surface	4.80mm	-	-	-	4.800mm
8	Site 2795 Surface	3.80mm	4.10mm	4.20mm	-	4.033mm
9	Site 2795 Surface	4.20mm	4.10mm	4.10mm	4.50mm	4.225mm
10	Site 2795 Surface	4.70mm	4.20mm	4.80mm	-	4.567mm
11	Site 2795 Surface	6.00mm	5.40mm	5.60mm	6.00mm	5.750mm
12	Site 2795 Surface	4.80mm	4.30mm	4.00mm	-	4.367mm
13	Site 2795 Surface	5.10mm	4.60mm	4.90mm	5.20mm	4.950mm
14	Site 2795 Surface	5.30mm	6.10mm	6.00mm	-	5.800mm
15	Site 2795 Surface	4.50mm	4.80mm	5.20mm	4.90mm	4.850mm
16	Site 2795 Surface	5.10mm	5.10mm	4.80mm	5.00mm	5.000mm
17	Site 2795 Surface	5.00mm	5.20mm	4.30mm	-	4.833mm
18	Site 2795 Surface	4.70mm	5.10mm	5.80mm	4.80mm	5.100mm
19	Site 2795 Surface	5.30mm	5.40mm	5.90mm	5.40mm	5.500mm
20	Site 2795 Surface	4.30mm	4.70mm	4.70mm	4.70mm	4.600mm
21	Site 2795 Surface	3.60mm	3.50mm	4.20mm	4.10mm	3.850mm
22	Site 2795 Surface	4.30mm	4.60mm	5.10mm	-	4.667mm
23	Site 2795 Surface	5.50mm	4.90mm	-	-	5.200mm
24	Site 2795 Surface	5.30mm	5.10mm	4.20mm	4.00mm	4.650mm
25	Site 2795 Surface	4.70mm	5.40mm	-	-	5.050mm
26	Site 2795 Surface	4.20mm	4.20mm	4.10mm	-	4.167mm
27	Site 2795 Surface	4.80mm	5.20mm	5.20mm	-	5.067mm
28	Site 2795 Surface	5.00mm	4.70mm	4.50mm	-	4.733mm
29	Site 2795 Surface	5.40mm	5.30mm	5.20mm	5.00mm	5.225mm
30	Site 2795 Surface	4.50mm	5.20mm	4.90mm	5.20mm	4.950mm
31	Site 2795 Surface	4.30mm	5.10mm	4.50mm	5.00mm	4.725mm
32	Site 2795 Surface	6.20mm	5.70mm	5.40mm	5.50mm	5.700mm
33	Site 2795 Surface	5.20mm	5.70mm	5.20mm	5.50mm	5.400mm

		Date Estimate w/ 1 sigma Error		
Mean Site Thickness	4.934mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 968	A.D. 1014	A.D. 1060
Quadratic Reggression		A.D. 993	A.D. 1035	A.D. 1077

Table B.20. Site 03070102796 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 2796 Surface	7.60mm	6.50mm	6.80mm	7.30mm	7.050mm
2	Site 2796 Surface	6.00mm	7.30mm	7.30mm	6.70mm	6.825mm
3	Site 2796 Surface	7.50mm	7.80mm	7.60mm	7.80mm	7.675mm
4	Site 2796 Surface	5.70mm	6.20mm	5.50mm	5.30mm	5.675mm
5	Site 2796 Surface	5.50mm	5.20mm	5.90mm	-	5.533mm
6	Site 2796 Surface	5.40mm	5.10mm	5.10mm	5.00mm	5.150mm
7	Site 2796 Surface	5.00mm	5.30mm	-	-	5.150mm
8	Site 2796 Surface	5.80mm	5.20mm	5.40mm	-	5.467mm
9	Site 2796 Surface	8.20mm	8.60mm	8.90mm	8.30mm	8.500mm
10	Site 2796 Surface	5.20mm	5.10mm	4.80mm	4.50mm	4.900mm
11	Site 2796 Surface	4.90mm	5.50mm	5.50mm	5.30mm	5.300mm
12	Site 2796 Surface	4.50mm	5.00mm	-	-	4.750mm
13	Site 2796 Surface	5.20mm	5.20mm	5.20mm	-	5.200mm
14	Site 2796 Surface	6.90mm	6.90mm	-	-	6.900mm
15	Site 2796 Surface	5.40mm	5.10mm	5.20mm	-	5.233mm
16	Site 2796 Surface	5.90mm	5.40mm	5.20mm	5.60mm	5.525mm
17	Site 2796 Surface	5.20mm	5.30mm	-	-	5.250mm
18	Site 2796 Surface	5.70mm	5.60mm	6.00mm	5.80mm	5.775mm
19	Site 2796 Surface	6.40mm	6.30mm	5.90mm	6.10mm	6.175mm
20	Site 2796 Surface	5.80mm	5.60mm	5.50mm	-	5.633mm
21	Site 2796 Surface	6.50mm	7.10mm	-	-	6.800mm
22	Site 2796 Surface	5.50mm	6.50mm	-	-	6.000mm
23	Site 2796 Surface	6.30mm	6.20mm	-	-	6.250mm
24	Site 2796 Surface	6.20mm	6.40mm	6.40mm	-	6.333mm
25	Site 2796 Surface	5.80mm	5.80mm	5.60mm	-	5.733mm
26	Site 2796 Surface	4.00mm	4.40mm	3.90mm	-	4.100mm
27	Site 2796 Surface	4.10mm	4.00mm	-	-	4.050mm
28	Site 2796 Surface	6.00mm	6.50mm	6.60mm	-	6.367mm
29	Site 2796 Surface	6.00mm	6.10mm	5.60mm	-	5.900mm
30	Site 2796 Surface	6.50mm	6.10mm	5.20mm	-	5.933mm
31	Site 2796 Surface	6.10mm	6.20mm	-	-	6.150mm
32	Site 2796 Surface	5.70mm	5.50mm	5.70mm	5.80mm	5.675mm
33	-	-	-	-	-	-

		Date Estimate w/ 1 sigma Error		
Mean Site Thickness	5.842mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 1188	A.D. 1234	A.D. 1280
Quadratic Reggression		A.D. 1108	A.D. 1150	A.D. 1192

Table B.21. Site 03070102800 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 2800 Surface	5.90mm	6.40mm	6.60mm	6.60mm	6.38mm
2	Site 2800 Surface	5.00mm	4.70mm	4.40mm	4.80mm	4.73mm
3	Site 2800 Surface	7.00mm	6.30mm	6.90mm	7.00mm	6.80mm
4	Site 2800 Surface	4.90mm	4.90mm	5.10mm	4.80mm	4.93mm
5	Site 2800 Surface	6.10mm	5.80mm	6.60mm	7.20mm	6.43mm
6	Site 2800 Surface	5.60mm	6.00mm	5.70mm	6.10mm	5.85mm
7	Site 2800 Surface	5.30mm	4.90mm	4.80mm	4.40mm	4.85mm
8	Site 2800 Surface	5.10mm	5.00mm	4.40mm	5.10mm	4.90mm
9	Site 2800 Surface	5.20mm	6.60mm	6.50mm	5.90mm	6.05mm
10	Site 2800 Surface	5.10mm	4.90mm	4.80mm	5.40mm	5.05mm
11	Site 2800 Surface	6.70mm	5.30mm	5.70mm	7.10mm	6.20mm
12	Site 2800 Surface	4.90mm	4.70mm	4.60mm	5.00mm	4.80mm
13	Site 2800 Surface	4.60mm	4.80mm	4.60mm	5.00mm	4.75mm
14	Site 2800 Surface	5.70mm	5.20mm	5.40mm	5.50mm	5.45mm
15	Site 2800 Surface	4.50mm	5.00mm	5.10mm	4.80mm	4.85mm
16	Site 2800 Surface	6.60mm	6.60mm	7.00mm	6.80mm	6.75mm
17	Site 2800 Surface	6.00mm	6.20mm	5.80mm	5.80mm	5.95mm
18	Site 2800 Surface	4.90mm	4.40mm	4.20mm	4.40mm	4.48mm
19	Site 2800 Surface	6.30mm	6.80mm	6.40mm	6.70mm	6.55mm
20	Site 2800 Surface	5.10mm	5.20mm	4.80mm	5.10mm	5.05mm
21	Site 2800 Surface	6.50mm	6.30mm	6.50mm	6.60mm	6.48mm
22	Site 2800 Surface	4.50mm	5.10mm	6.00mm	6.10mm	5.43mm
23	Site 2800 Surface	7.20mm	7.00mm	7.20mm	7.10mm	7.13mm
24	Site 2800 Surface	5.80mm	6.10mm	6.60mm	5.60mm	6.03mm
25	Site 2800 Surface	6.90mm	6.70mm	6.60mm	6.80mm	6.75mm
26	Site 2800 Surface	6.20mm	6.10mm	6.00mm	6.20mm	6.13mm
27	Site 2800 Surface	4.50mm	4.60mm	4.30mm	4.50mm	4.48mm
28	Site 2800 Surface	5.30mm	5.10mm	5.00mm	5.30mm	5.18mm
29	Site 2800 Surface	4.30mm	4.70mm	5.00mm	4.70mm	4.68mm
30	Site 2800 Surface	6.10mm	5.50mm	5.80mm	5.70mm	5.78mm
31	Site 2800 Surface	4.40mm	4.50mm	4.80mm	5.20mm	4.73mm
32	Site 2800 Surface	5.20mm	6.00mm	6.40mm	6.10mm	5.93mm
33	Site 2800 Surface	5.80mm	6.10mm	6.10mm	5.90mm	5.98mm

		Date Estimate w/ 1 sigma Error		
Mean Site Thickness	5.619mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 1134	A.D. 1180	A.D. 1226
Quadratic Reggression		A.D. 1100	A.D. 1142	A.D. 1184

Table B.22. Site 03070102803 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 2803 Surface	4.30mm	4.20mm	4.40mm	4.30mm	4.300mm
2	Site 2803 Surface	6.60mm	6.60mm	5.70mm	6.00mm	6.225mm
3	Site 2803 Surface	6.40mm	7.60mm	7.70mm	6.20mm	6.975mm
4	Site 2803 Surface	5.40mm	5.00mm	5.40mm	5.20mm	5.250mm
5	Site 2803 Surface	4.20mm	4.50mm	4.70mm	4.70mm	4.525mm
6	Site 2803 Surface	4.20mm	3.90mm	4.30mm	4.10mm	4.125mm
7	Site 2803 Surface	5.20mm	4.80mm	4.80mm	5.40mm	5.050mm
8	Site 2803 Surface	4.90mm	4.40mm	4.10mm	4.40mm	4.450mm
9	Site 2803 Surface	3.30mm	3.40mm	3.60mm	3.70mm	3.500mm
10	Site 2803 Surface	5.10mm	5.40mm	5.60mm	5.40mm	5.375mm
11	Site 2803 Surface	5.50mm	5.30mm	5.20mm	-	5.333mm
12	Site 2803 Surface	3.90mm	3.60mm	3.80mm	3.90mm	3.800mm
13	Site 2803 Surface	5.00mm	5.30mm	5.50mm	5.20mm	5.250mm
14	Site 2803 Surface	5.20mm	4.90mm	4.90mm	5.40mm	5.100mm
15	Site 2803 Surface	4.30mm	4.40mm	4.30mm	4.30mm	4.325mm
16	Site 2803 Surface	5.60mm	5.40mm	5.00mm	5.00mm	5.250mm
17	Site 2803 Surface	5.70mm	6.10mm	5.60mm	5.50mm	5.725mm
18	Site 2803 Surface	4.70mm	5.20mm	4.90mm	4.50mm	4.825mm
19	Site 2803 Surface	4.90mm	5.30mm	5.20mm	5.20mm	5.150mm
20	Site 2803 Surface	4.40mm	4.20mm	4.40mm	4.50mm	4.375mm
21	Site 2803 Surface	4.60mm	4.10mm	4.20mm	4.10mm	4.250mm
22	Site 2803 Surface	4.00mm	4.20mm	4.10mm	3.80mm	4.025mm
23	Site 2803 Surface	6.00mm	5.60mm	6.00mm	5.90mm	5.875mm
24	Site 2803 Surface	5.10mm	5.70mm	4.50mm	5.20mm	5.125mm
25	Site 2803 Surface	4.80mm	4.70mm	4.60mm	5.00mm	4.775mm
26	Site 2803 Surface	4.20mm	4.50mm	4.80mm	4.70mm	4.550mm
27	Site 2803 Surface	4.80mm	4.70mm	4.70mm	4.50mm	4.675mm
28	Site 2803 Surface	4.30mm	4.80mm	5.40mm	4.90mm	4.850mm
29	Site 2803 Surface	5.20mm	5.40mm	5.10mm	4.90mm	5.150mm
30	Site 2803 Surface	4.20mm	4.50mm	4.60mm	4.50mm	4.450mm
31	Site 2803 Surface	4.90mm	5.10mm	5.40mm	5.20mm	5.150mm
32	Site 2803 Surface	3.40mm	3.70mm	3.60mm	3.30mm	3.500mm
33	Site 2803 Surface	4.50mm	4.30mm	4.10mm	4.40mm	4.325mm

		Date Estimate w/ 1 sigma Error		
Mean Site Thickness	4.837mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 945	A.D. 991	A.D. 1037
Quadratic Reggression		A.D. 968	A.D. 1010	A.D. 1052

Table B.23. Site 03070100301 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 0301 Surface	4.81mm	4.71mm	4.62mm	4.86mm	4.750mm
2	Site 0301 Surface	4.82mm	4.18mm	4.75mm	5.15mm	4.725mm
3	Site 0301 Surface	6.21mm	4.57mm	4.26mm	6.01mm	5.263mm
4	Site 0301 Surface	7.15mm	7.55mm	8.17mm	7.53mm	7.600mm
5	Site 0301 Surface	7.36mm	7.27mm	6.97mm	7.02mm	7.155mm
6	Site 0301 Surface	5.51mm	5.29mm	4.89mm	5.11mm	5.200mm
7	Site 0301 Surface	6.78mm	6.90mm	6.51mm	6.83mm	6.755mm
8	Site 0301 Surface	6.09mm	5.89mm	5.65mm	5.83mm	5.865mm
9	Site 0301 Surface	4.76mm	4.95mm	4.89mm	4.79mm	4.848mm
10	Site 0301 Surface	5.04mm	5.69mm	6.18mm	5.55mm	5.615mm
11	Site 0301 Surface	5.60mm	5.50mm	5.23mm	5.44mm	5.443mm
12	Site 0301 Surface	5.23mm	5.23mm	5.43mm	5.14mm	5.258mm
13	Site 0301 Surface	6.61mm	6.86mm	6.84mm	6.70mm	6.753mm
14	Site 0301 Surface	7.16mm	6.85mm	6.70mm	6.99mm	6.925mm
15	Site 0301 Surface	5.69mm	5.60mm	5.50mm	5.36mm	5.538mm
16	Site 0301 Surface	4.13mm	4.30mm	4.72mm	4.49mm	4.410mm
17	Site 0301 Surface	7.35mm	7.38mm	7.20mm	7.00mm	7.233mm
18	Site 0301 Surface	7.66mm	7.38mm	7.92mm	7.60mm	7.640mm
19	Site 0301 Surface	6.20mm	5.82mm	5.56mm	-	5.860mm
20	Site 0301 Surface	5.96mm	5.29mm	5.47mm	5.75mm	5.618mm
21	Site 0301 Surface	5.61mm	5.85mm	5.88mm	5.99mm	5.833mm
22	Site 0301 Surface	4.90mm	5.71mm	5.23mm	5.04mm	5.220mm
23	Site 0301 Surface	5.08mm	4.82mm	5.16mm	5.19mm	5.063mm
24	Site 0301 Surface	5.48mm	5.26mm	4.96mm	5.94mm	5.410mm
25	Site 0301 Surface	4.98mm	4.88mm	5.05mm	5.18mm	5.023mm
26	Site 0301 Surface	4.92mm	5.01mm	4.62mm	4.57mm	4.780mm
27	Site 0301 Surface	4.96mm	4.70mm	4.94mm	4.60mm	4.800mm
28	Site 0301 Surface	3.91mm	4.14mm	4.20mm	3.88mm	4.033mm
29	-	-	-	-	-	-
30	-	-	-	-	-	-
31	-	-	-	-	-	-
32	-	-	-	-	-	-
33	-	-	-	-	-	-

		Date Estimate w/ 1 sigma Error		
Mean Site Thickness	5.665mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 1145	A.D. 1191	A.D. 1237
Quadratic Reggression		A.D. 1103	A.D. 1145	A.D. 1187

Table B.24. Site 03070200836 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
1	Site 0836 Surface	6.90mm	7.63mm	6.97mm	8.23mm	7.433mm
2	Site 0836 Surface	6.78mm	6.26mm	6.25mm	6.37mm	6.415mm
3	Site 0836 Surface	6.64mm	6.84mm	7.53mm	7.41mm	7.105mm
4	Site 0836 Surface	5.55mm	5.31mm	6.40mm	6.41mm	5.918mm
5	Site 0836 Surface	6.55mm	6.90mm	6.94mm	6.89mm	6.820mm
6	Site 0836 Surface	6.06mm	5.15mm	6.09mm	5.96mm	5.815mm
7	Site 0836 Surface	5.05mm	5.16mm	5.44mm	5.26mm	5.228mm
8	Site 0836 Surface	5.70mm	6.07mm	6.39mm	6.75mm	6.228mm
9	Site 0836 Surface	5.34mm	6.09mm	7.65mm	7.57mm	6.663mm
10	Site 0836 Surface	5.87mm	5.01mm	5.08mm	5.04mm	5.250mm
11	Site 0836 Surface	6.45mm	6.24mm	6.58mm	5.92mm	6.298mm
12	Site 0836 Surface	4.89mm	5.03mm	4.85mm	4.65mm	4.855mm
13	Site 0836 Surface	5.88mm	4.51mm	5.43mm	5.74mm	5.390mm
14	Site 0836 Surface	5.71mm	5.62mm	5.18mm	5.62mm	5.533mm
15	Site 0836 Surface	4.48mm	4.18mm	4.05mm	4.35mm	4.265mm
16	Site 0836 Surface	5.73mm	4.89mm	5.04mm	4.92mm	5.145mm
17	Site 0836 Surface	6.13mm	5.67mm	5.51mm	5.91mm	5.805mm
18	Site 0836 Surface	5.00mm	4.55mm	5.55mm	5.11mm	5.053mm
19	Site 0836 Surface	5.51mm	5.41mm	5.74mm	5.74mm	5.600mm
20	Site 0836 Surface	5.34mm	5.13mm	5.64mm	5.25mm	5.340mm
21	Site 0836 Surface	5.56mm	5.25mm	4.99mm	5.10mm	5.225mm
22	Site 0836 Surface	4.88mm	5.82mm	4.95mm	5.30mm	5.238mm
23	Site 0836 Surface	7.09mm	7.01mm	7.31mm	7.09mm	7.125mm
24	Site 0836 Surface	5.74mm	6.13mm	6.17mm	5.75mm	5.948mm
25	Site 0836 Surface	7.00mm	6.13mm	6.01mm	6.96mm	6.525mm
26	Site 0836 Surface	4.98mm	5.57mm	5.30mm	5.50mm	5.338mm
27	Site 0836 Surface	5.26mm	5.93mm	6.69mm	6.61mm	6.123mm
28	Site 0836 Surface	5.92mm	5.98mm	5.62mm	5.97mm	5.873mm
29	Site 0836 Surface	5.97mm	5.71mm	5.31mm	5.50mm	5.623mm
30	Site 0836 Surface	6.74mm	6.51mm	6.13mm	6.24mm	6.405mm
31	Site 0836 Surface	6.13mm	5.71mm	5.75mm	5.59mm	5.795mm
32	Site 0836 Surface	6.02mm	5.58mm	5.75mm	6.35mm	5.925mm
33	Site 0836 Surface	6.00mm	6.02mm	5.73mm	5.50mm	5.813mm
34	Site 0836 Surface	6.46mm	6.39mm	6.28mm	6.47mm	6.400mm
35	Site 0836 Surface	4.75mm	5.53mm	4.92mm	4.46mm	4.915mm
36	Site 0836 Surface	5.58mm	6.09mm	5.57mm	5.65mm	5.723mm
37	Site 0836 Surface	6.06mm	6.24mm	6.04mm	6.08mm	6.105mm
38	Site 0836 Surface	6.52mm	6.39mm	6.77mm	6.64mm	6.580mm
39	Site 0836 Surface	4.90mm	5.49mm	4.60mm	4.73mm	4.930mm
40	Site 0836 Surface	6.68mm	6.49mm	6.80mm	6.66mm	6.658mm

Table B.24 continued. Site 03070100238 mean sherd thickness data.

Sherd Number	Context	Thickness 1	Thickness 2	Thickness 3	Thickness 4	Mean Thickness
41	Site 0836 Surface	6.41mm	6.32mm	7.76mm	7.75mm	7.060mm
42	Site 0836 Surface	7.28mm	6.73mm	6.56mm	7.11mm	6.920mm
43	Site 0836 Surface	4.92mm	5.48mm	4.86mm	4.70mm	4.990mm
44	Site 0836 Surface	6.48mm	6.13mm	6.22mm	4.97mm	5.950mm
45	Site 0836 Surface	6.00mm	5.79mm	5.94mm	6.13mm	5.965mm
46	Site 0836 Surface	5.22mm	4.89mm	5.27mm	4.54mm	4.980mm

		Date Estimate w/ 1 sigma Error		
Mean Site Thickness	5.876mm	**minus 1σ**	**Date**	**plus 1σ**
Linear Regression		A.D. 1196	A.D. 1242	A.D. 1288
Quadratic Reggression		A.D. 1108	A.D. 1150	A.D. 1192